Larson's Musical Forces in Vivaldi's Bassoon Concerti

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In his book *Musical Forces: Motion, Metaphor, and Meaning in Music*,[1] Steve Larson presents a theory of musical forces. Before presenting these forces, he talks about some metaphors that are used when talking about music. Specifically, he points out that motion is commonly used as a metaphor for music. He claims that our embodied understanding of physical motion manifests itself in the way we talk about music and musical motion. Since physical motion is governed by physical forces, it follows that musical motion can be described with correlating musical forces. He focuses primarily on three musical forces: melodic gravity, melodic magnetism, and musical inertia. These metaphorical forces act on music much in the same way that the corresponding physical forces act on physical objects. Melodic gravity is the tendency for notes to descend, just as physical gravity pulls objects down. Melodic magnetism is the tendency for unstable pitches to move to the nearest stable pitch. This correlates with magnetic objects in the physical world. Musical inertia is the tendency for patterns of pitches, durations, or both to continue in the same fashion, the same as physical inertia.[2]

This study aims to be a corpus study of these musical forces, using a body of Vivaldi's bassoon concerti as a sample. Vivaldi completed thirty-seven bassoon concerti, and left two more unfinished. Eighteen of these thirty-seven bassoon concerti were encoded to be used with the humdrum toolkit in this study. The humdrum toolkit is a set of Unix command line programs used to analyze music empirically. The humdrum commands work well with existing Unix programs, and can link together to form chains of commands to investigate specific questions. The flexibility of the toolkit is especially useful for studying large bodies of repertoire, as queries can be made over the whole group and answered quickly.

1. Steve Larson, *Musical Forces: Motion, Metaphor, and Meaning in Music* (Bloomington: Indiana University Press, 2012).
2. Larson, 1–2.

Collection of works

The sample of Vivaldi's bassoon concerti used in this study includes the following: RV 471, RV 472, RV 473, RV 477, RV 480, RV 481, RV 483, RV 484, RV 485, RV 487, RV 488, RV 493, RV 495, RV 496, RV 497, RV 498, RV 501, and RV 502. This sample contains at least one concerto in every key for which Vivaldi wrote a concerto, and represents eighteen of the total thirty-seven he wrote. In total, fifty-six movements are used in this study.

Process of encoding

The process used to encode these scores involved using a scanner, Adobe Acrobat Reader, Mac OS X Software Preview, the music notation software Finale, the humdrum command xml2hum, the text editor emacs, and the humdrum command proof.

First, the scores were scanned using the scanner and Acrobat. Then Preview was used to convert the PDF files into TIFF images. Then Finale was used to import the TIFF files, and clean up errors from the scanning and importing process. At this stage, Finale played the file and was compared aurally to the score to check for errors in the scanning process. Then the file was exported as a musicxml file. The humdrum command xml2hum converted the file into humdrum format. Finally, the humdrum command proof was used to check for errors in the file, which were fixed using emacs. In this process, only the solo part for the bassoon was encoded. Tutti sections and accompaniment were not included. Additionally, only the pitch and rhythm were encoded. Phrase boundaries, articulations, dynamics, and trills were excluded in this study.

Melodic Gravity

Larson defines melodic gravity as "the tendency of a note (heard as 'above a stable position') to descend."[3] If Vivaldi's bassoon concerti conform to this force, there should be a tendency of descending motion, especially after upward leaps. Historic compositional practice says that an ascending leap should be followed by stepwise, descending motion. The deg representation in humdrum represents pitch by scale degree, and ascent or descent with ôr v characters, respectively.

3. Larson, *Musical Forces: Motion, Metaphor, and Meaning in Music*, 83.

The command context juxtaposes sequential parts of a file together. For example, a file with the lines 1, 2, 3, 4 would change to 1 2, 2 3, 3 4 with context. This is useful for comparing groups of information, such as scale degrees, intervals, etc., and can change how many elements are compared at a time. Other humdrum and Unix commands can be used to filter, sort, and count elements of these files. Table 1 shows the number and percentage of occurrences where each scale degree descended stepwise. In this case, context grouped scale degrees into pairs to examine how each scale degree moved to the next. Upon first observation, this data may not seem to conform with

Table 1: Stepwise Descent by Scale Degree

Scale Degree	Stepwise Descent	Total Intervals	Percentage
1	1058	4021	26.34%
2	1070	3439	31.11%
3	1079	3628	29.74%
4	1072	3381	31.71%
5	1091	4057	26.89%
6	970	2950	32.88%
7	899	3158	28.47%

the idea of melodic gravity. Scale degrees 1 and 5 especially seem not to provide strong evidence. One problem with this process is that a note may repeat itself, and then descend. This may be most evident in 1 and 5 as those are important structural notes in tonal music. Table 2 shows the same data, but repetitions of notes were excluded in the calculations. This data strengthens

Table 2: Stepwise Descent by Scale Degree (Repeated Notes Omitted)

Scale Degree	Stepwise Descent	Total Intervals	Percentage
1	1058	3272	32.37%
2	1070	3035	35.26%
3	1079	3187	33.86%
4	1072	2960	36.22%
5	1091	3335	32.71%
6	970	2604	37.25%
7	899	2811	31.98%

the evidence that melodic gravity is a force acting on this music. Although there is much stepwise motion in this music, descending motion of any interval would still be attributed to the force of gravity. Table 3 shows the number of descending intervals for each scale degree. This data shows that descending motion is more prevalent than ascending motion, but not by much. If slightly more than half of the intervals are descending, it follows that only slightly less than half of the

Table 3: Descent by Scale Degree (Repeated Notes Omitted)

Scale Degree	Stepwise Descent	Total Intervals	Percentage
1	1813	3511	51.64%
2	1753	3160	55.47%
3	1865	3344	55.77%
4	1706	3084	55.42%
5	1893	3680	51.44%
6	1482	2706	54.77%
7	1477	2903	50.88%

intervals are ascending. This does not seem to provide strong evidence to support melodic gravity. Larson notes in his book that melodic gravity is weaker than the other forces he discusses, and that melodic gravity is often easier seen at the global level than the local level.[4]

One way to examine this is by looking at the melodic contour of a piece. David Huron has shown using humdrum that in European folksongs melodies typically have an arch shape.[5] These arches show that melodies ascend, then descend back to their starting point, much like the trajectory of throwing a ball. When throwing a ball, an arch shape is formed because of physical gravity. Then melodic gravity would be the analogous force that creates the arch shapes in music. If Vivaldi's concerti possess these arch shapes, they would support the theory that there is melodic gravity. To examine this, the humdrum representation semits was used. Semits represents the pitch for each note as the number of half steps above or below middle C. Using this representation and the Unix plotting software gnuplot, each movement was graphed to visualize its contour. The second movement from RV 484 is an example of those graphs.

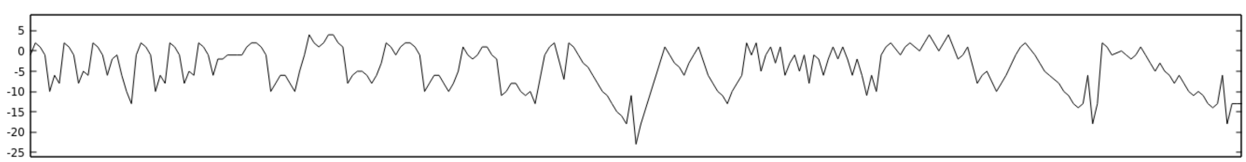


Figure 1: RV 484 Movement 2

These graphs make it easy to see that following an ascent, melodies tend to descend. This is demonstrated by the prevalence of arch shapes throughout the graph. The contour graph for each movement is included as an appendix to this paper. All the graphs show a similar prevalence

4. Larson, *Musical Forces: Motion, Metaphor, and Meaning in Music*, 88.
5. David Huron, "The Melodic Arch in Western Folksongs," *Computing in Musicology* 10 (1995-96): 3–23.

of descending motion after ascents, and melodic arch shapes. These graphs provide the strongest evidence supporting the force of melodic gravity in Vivaldi's concerti.

To summarize, Vivaldi's bassoon concerti support musical gravity as a musical force. There is a tendency of notes to descend, especially when repeated notes are removed. The graphs of melodic contour show clear patterns that what goes up comes down. These graphs highlight that melodic gravity is more recognizable at the global level than the local level.

Melodic Magnetism

"Melodic magnetism is the tendency of an unstable note to move to the closest stable pitch, a tendency that grows stronger as we get closer to that goal."[6] The most stable pitches in the major and minor scales are 1, 3, and 5. If these concerti have melodic magnetism, then unstable pitches will move to stable scale degrees more often than other scale degrees. This information is straightforward to find with the deg representation in humdrum. All the movements in a major key were combined into one file, as well as the minor key movements. Table 4 shows the data for each scale degree, excluding repeated pitches.

Table 4: Unstable to Stable Resolutions

Major				Minor			
Degree	Resolutions	Total	Percent	Degree	Resolutions	Total	Percent
1+	1	110	0.91%	1-	8	7	100.00%
2	981	1643	59.71%	2-	2	2	100.00%
2+	23	67	34.33%	2	302	1117	27.04%
3-	9	21	42.86%	3+	59	160	36.88%
4	418	1093	38.24%	4	752	1274	59.03%
4+	193	502	38.45%	4+	39	99	39.39%
5+	59	144	40.97%	5-	20	25	80.00%
6-	11	14	78.57%	6	341	829	41.13%
6	453	1496	30.28%	6+	94	262	35.88%
6+	3	6	50.00%	7-	180	850	21.18%
7-	79	189	41.80%	7	132	320	41.25%
7	471	1459	32.28%				

The data seems to support the idea of magnetism in most cases, although some entries, like 7, don't seem to be as affected by magnetism. One probable reason for this is that magnetism, while stronger than gravity, is not as strong as inertia. For the movements in a minor key, a lowered

6. Larson, *Musical Forces: Motion, Metaphor, and Meaning in Music*, 88.

7 moved to 6 26% of the time. Scale degree one, however, is a closer stable pitch. If the lowered 7is approached from 1, then musical inertia would tend to move to 6. Another difficulty arises from modulations or temporary tonicizations within the movements. Ignoring harmonic function, a raised 1 would descend to 1 because of magnetism. However, this occurred only once in the sample, as the tendency is to move to 2. In Vivaldi's bassoon concerti, sequences are very common. In these sequences, a raised 1 likely is not functioning in the tonic key, which would explain the tendency to move to 2.

While there is much data to support melodic magnetism in Vivaldi's bassoon concerti, the evidence is not clear for every unstable pitch. Larson does say that musical inertia is the strongest of these forces, and it can be seen hereafter that many of the weak areas in the magnetism data can be explained through the strength of musical inertia.

Musical Inertia

"Musical inertia is the tendency of a pattern of motion to continue in the same fashion."[7] Additionally, "inertia is both the tendency of an object in motion to remain in motion and the tendency of an object at rest to remain at rest."[8] Compared to the other forces, Larson says that "inertia has an impact that is stronger than gravity and more pervasive than magnetism."[9] Thus if musical inertia is an acting force in Vivaldi's concerti, then there should be a prevalence of movement in the same direction, or in similar patterns. Another representation of humdrum is mint. Mint represents intervals as opposed to pitches. Table 5 shows how frequently an interval continues in the same direction.

Larson cites Paul von Hippel and his term "step inertia," which states that stepwise motion tends to continue in the same direction.[10] Table 5 seems to support this claim. Using higher levels of context, this claim can be tested further. Table 6 examines stepwise motion up to six intervals.

The data gives strong evidence to von Hippel's claim. In all cases, descending motion was more likely to continue descending. This likely reflects the influence of melodic gravity that is also acting on the music. How does inertia effect motion that is not stepwise? Table 5 above seems

7. Larson, *Musical Forces: Motion, Metaphor, and Meaning in Music*, 96.
8. Larson, 100.
9. Larson, 100.
10. Larson, 99.

Table 5: Continuation by Interval

Interval	Continuation	Total Intervals	Percentage
1	355	2031	17.48%
↓2	3571	6622	53.93%
↑2	2066	4995	41.36%
↓3	236	1648	14.32%
↑3	278	1660	16.75%
↓4	2	594	0.34%
↑4	0	663	0.00%
↓5	0	0	0.00%
↑5	2	477	0.42%
↓6	2	530	0.38%
↑6	1	566	0.18%
↓7	0	0	0.00%
↑7	0	0	0.00%
↓8	2	452	0.44%
↑8	2	478	0.42%

Table 6: Continuation by Stepwise Motion

Interval	Continuation	Total Intervals	Percentage
↓2↓2	1905	3432	55.51%
↑2↑2	1030	1994	51.65%
↓2↓2↓2	1196	1831	65.32%
↑2↑2↑2	643	993	64.75%
↓2↓2↓2↓2	757	1138	66.52%
↑2↑2↑2↑2	407	619	65.75%
↓2↓2↓2↓2↓2	504	709	71.09%
↑2↑2↑2↑2↑2	255	387	65.89%
↓2↓2↓2↓2↓2↓2	316	464	68.10%
↑2↑2↑2↑2↑2↑2	144	239	60.25%

to suggest that motion does not continue in the same fashion frequently for intervals larger than a third. However, motion could still be moving in the same direction, just using different interval sizes. Table 7 shows the continuation of direction for two intervals.

This data strengthens the above view that descending motion continues more than ascending motion because of the influence of melodic gravity. However, it is more common for the direction to change instead of continuing in the same direction. Recall that musical inertia is the continuation of patterns in the same fashion. Examining this data at further levels reveals that there is a pattern of changing direction with every note. Table 8 shows this trend for interval groups up to seven intervals.

Table 7: Continuation by Direction

Pattern	Occurences	Percentage
↑↑	3951	18.34%
↓↓	5585	25.92%
↑↓	6167	28.62%
↓↑	5845	27.12%
Total	**21548**	**100%**

Table 8: Continuation of Changing Direction

Pattern	Continuation	Total Occurences	Percentage
↑	6167	10118	60.95%
↓	5845	11430	51.14%
↑↓	3457	5899	58.60%
↓↑	3897	5693	68.45%
↑↓↑	2471	3383	73.04%
↓↑↓	2408	3716	64.80%
↑↓↑↓	1977	2365	83.59%
↓↑↓↑	2015	2355	85.56%
↑↓↑↓↑	1736	1947	89.16%
↓↑↓↑↓	1686	1922	87.72%
↑↓↑↓↑↓	1476	1655	89.18%
↓↑↓↑↓↑	1509	1660	90.90%

This data supports that inertia is acting on the pattern of alternating direction in Vivaldi's bassoon concerti. This evidence is strengthened the longer the pattern continues. This reflects a common element in Vivaldi's bassoon concerti, namely compound melodies. Frequently Vivaldi will write an extended pattern of sixteenth notes, where the first and third sixteenth notes in each group form a descending passage. But on the second and the fourth sixteenth notes a higher pitch is repeated until the end of the pattern. This creates the alternating direction patterns in the data.

Inertia also states that objects at rest will stay at rest. Table 9 shows the percentage of pitch sequences that remain on the same pitch.

Table 9: Continuation of Rest

Scale Degree	Continuation	Total Intervals	Percentage
1 1 1	224	730	30.68%
2 2 2	84	352	23.86%
3 3 3	90	402	22.39%
4 4 4	82	347	23.63%
5 5 5	224	691	32.42%
6 6 6	72	309	23.30%
7 7 7	31	177	17.51%

The data gives some evidence to support this aspect of inertia, but it is not as common as movement in this body of music. This is to be expected as music is more about temporal motion than being stagnant. The influence of magnetism can be seen in this data as well. It is reflected by the most stable pitches, scale degree one and five, having the highest percentage of staying on the same pitch. Scale degree seven especially shows the tendency to move away as an unstable pitch.

Another type of pattern in music is rhythm. Musical inertia would tend to show rhythmic activity also continuing in the same fashion. To evaluate the validity of this claim, the recip representation in humdrum was used. Recip contains only the rhythmic values of each note, represented by numbers, where one is a whole note, two is a half note, etc. Then using context groups of rhythms can be examined and compared. Table 10 shows the prevalence of repeated rhythms for two, three, and four duration groups. These percentages are of all rhythmic directions, not of continuation of the pattern. Thus, the sum of these percentages represents the percentage of repeated rhythmic motion overall.

This data supports the effect of inertia on rhythmic patterns. By far the most common pattern is repeating the previous rhythmic duration. Continuing this process up to ten durations still showed this trend, with 49.83% of rhythms being ten consecutive durations. Sixteenth note motion is the strongest example of this, accounting for about half of the repeated rhythms in all tests.

Musical inertia can be seen in many ways. The prevalence of stepwise motion continuing in the same direction is one example. In Vivaldi's bassoon concerti, there is also a pattern of alternating motion that is prevalent. Rhythmic repetition also is a characteristic in this music. While not as strong as these other examples, there is evidence to support musical inertia in pitches at rest staying at rest.

Interacting Forces

After discussing these musical forces, Larson states that these forces work together to form patterns. These patterns are formed by "a pattern that begins on a stable note, moves through an unstable note, ends with a stable note, and ends by giving in to one or more of the musical forces."[11] An

11. Larson, *Musical Forces: Motion, Metaphor, and Meaning in Music*, 156.

Table 10: Rhythmic Continuation

Two Durations		
Pattern	Continuation	Percentage
8 8	2017	8.51%
12 12	1217	5.13%
16 16	9460	39.91%
24 24	2541	10.72%
32 32	3046	12.85%
Repeated Rhythm	18946	79.93%
Three Durations		
Pattern	Continuation	Percentage
8 8 8	1441	6.30%
12 12 12	1143	4.99%
16 16 16	8227	35.95%
24 24 24	2369	10.35%
32 32 32	2355	10.29%
Repeated Rhythm	16056	70.16%
Four Durations		
Pattern	Continuation	Percentage
8 8 8 8	1148	5.20%
12 12 12 12	1069	4.84%
16 16 16 16	7355	33.30%
24 24 24 24	2199	9.96%
32 32 32 32	2079	9.41%
48 48 48 48	418	1.89%
Repeated Rhythm	14281	64.66%

example of this would be the motion of scale degree one moving through two to reach three. Scale degree two is unstable, and musical inertia moves two in the same direction to the stable three. Larson notes that not all step wise motion forms these patterns. The example he gives is scale degree five to four to five. After scale degree five moves to four, gravity would bring four down to three. Magnetism would do the same, as well as inertia. Then none of the musical forces would bring scale degree four up to five.[12] These patterns are mostly three-note patterns, with two four-note patterns. Table 11 shows the prevalence of these patterns in the sample. The table shows that given the first two notes, the percentage of the third notes that follow the specific pattern.

The data supports Larson's table of patterns in Vivaldi's concerti. Small percentages like scale degree one to two to one are often the result that there is another option for the third note that also is a pattern. Combining both patterns that start with scale degree one followed by two

12. Larson, *Musical Forces: Motion, Metaphor, and Meaning in Music*, 156.

Table 11: Patterns Influenced by Musical Forces

Pattern	Occurences	Total Patterns	Percentage
1→2→1	127	678	18.73%
1→2→3	284	678	41.89%
1→7→1	234	664	35.24%
3→2→1	512	948	54.01%
3→4→3	129	595	21.68%
3→4→5	250	595	42.02%
5→4→3	432	825	52.36%
5→6→5	158	622	25.40%
5→6→7→8	99	164	60.37%
8→7→6→5	129	254	50.79%

shows that over 60% follow musical forces. Some three-note patterns also share common beginnings as some four-note patterns. This accounts for the lower percentages of scale degree one to seven to one and scale degree five to six to five.

Larson also talks about the combination of these smaller musical patterns into larger ones. This is done by elision, where three-note patterns combine to make five-note patterns.[13] Table 12 shows these five-note patterns. This process can also be used to make connections of six-note and seven-note patterns, shown in tables 13 and 14 respectively. In the data from Table 12, there is strong support for these patterns. The discrepancies involving an ending of scale degree one to seven to one reflect the influence of the six-note patterns that take scale degree seven to six. The same argument applies to the row ending with scale degree five to six to five. In tables 13 and 14 similar discrepancies are seen for similar reasons. Overall, the data supports Larson's theories.

Table 12: Five-note Patterns

Pattern	Occurences	Total Patterns	Percentage
1→2→1→7→1	16	55	29.09%
1→2→3→4→3	22	108	20.37%
1→2→3→4→5	69	108	63.89%
1→7→1→2→1	12	53	22.64%
1→7→1→2→3	26	53	49.06%
3→2→1→7→1	31	151	20.53%
3→4→3→2→1	23	56	41.07%
3→4→5→6→5	10	92	10.87%
5→4→3→2→1	158	227	69.60%
5→6→5→4→3	27	80	33.75%

13. Larson, *Musical Forces: Motion, Metaphor, and Meaning in Music*, 159.

Table 13: Six-note Patterns

Pattern	Occurences	Total Patterns	Percentage
1→2→1→7→6→5	8	22	36.36%
1→7→1→7→6→5	9	24	37.50%
3→4→5→6→7→8	26	35	74.29%
5→6→5→6→7→8	7	11	63.64%

Table 14: Seven-note Patterns

Pattern	Occurences	Total Patterns	Percentage
1→2→1→7→1→2→3	3	3	100.00%
1→2→3→4→5→6→5	4	26	15.38%
1→7→1→2→3→4→3	3	9	33.33%
1→7→1→2→3→4→5	4	9	44.44%
3→4→3→2→1→7→1	2	5	40.00%
5→4→3→2→1→7→1	9	43	20.93%
5→6→5→4→3→2→1	6	8	75.00%

These musical patterns represent the interaction of all the musical forces that have been discussed in this study. Their prevalence both in three note patterns and extended patterns strongly supports Larson's theory of musical forces. This perhaps is the strongest evidence since all the musical forces are working together.

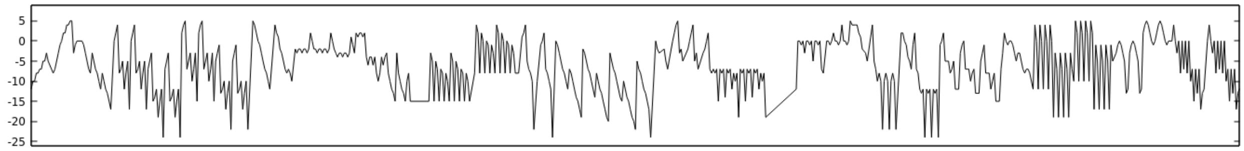
Conclusion

This study has attempted to verify Larson's claim that the musical forces of melodic gravity, melodic magnetism, and musical inertia shape Vivaldi's bassoon concerti. Considered individually, there is evidence to support his theory. Melodic gravity draws melodies down locally, but is easier seen at the global level. Melodic magnetism shows strong support in most cases. Those instances where the data does not support the theory can be explained through shifts in tonicization as well as the stronger effects of musical inertia. This inertia is seen in numerous ways, such as: stepwise motion in the same direction, patterns of alternating directions, rhythmic repetition, as well as to a limited extent, resting on the same pitch.

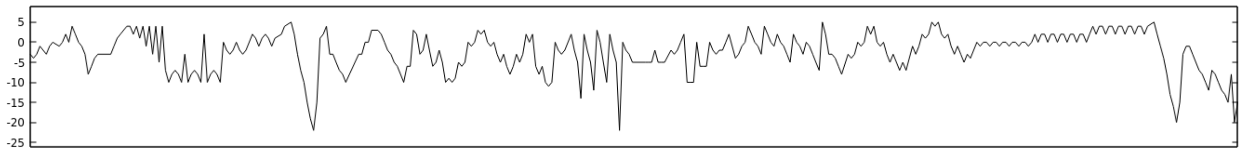
Individually, these forces are all strongly supported by the data. However, these forces are all acting upon the music at the same time. As such, the synthesis of these forces into musical patterns would lend the strongest evidence supporting musical forces. The data shows this to be the case. Three note and four note patterns driven by these musical forces are prevalent throughout this body of music. There is also strong support when these patterns are linked to form longer force-driven patterns. Indeed, the data supports Larson's theory of musical forces in Vivaldi's bassoon concerti.

Appendix: Melodic Contours

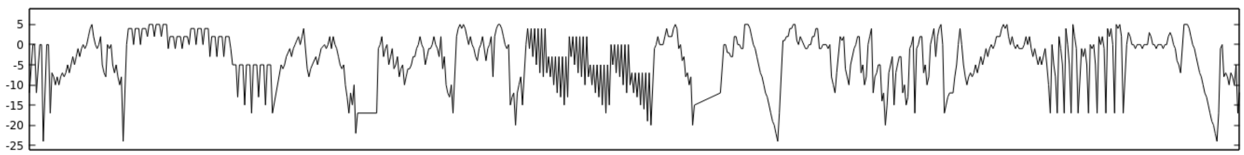
RV 471 Movement 1



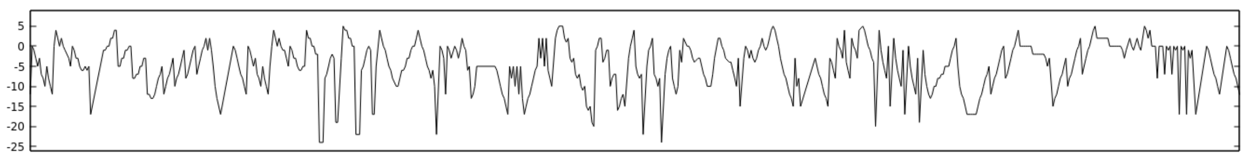
RV 471 Movement 2



RV 471 Movement 3



RV 472 Movement 1



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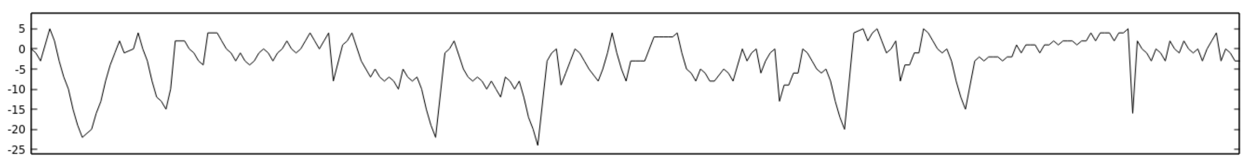
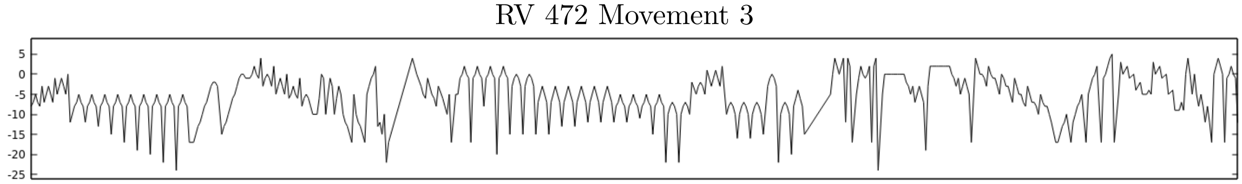
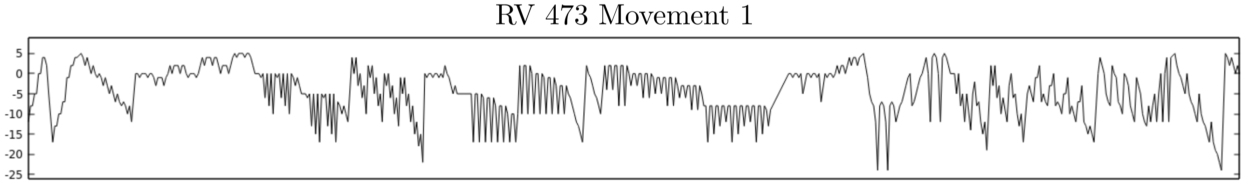


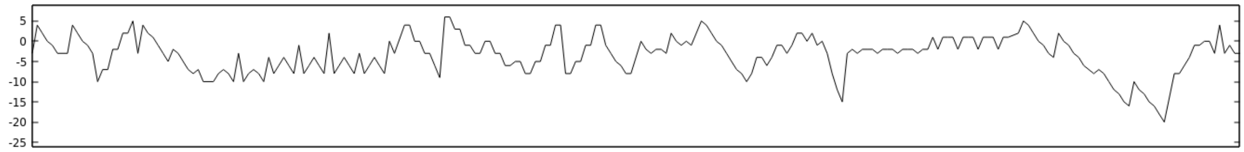
RV 472 Movement 3



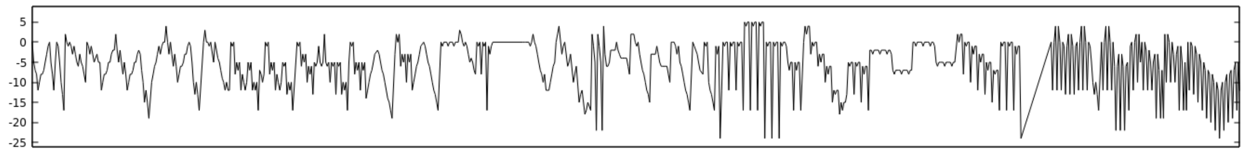
RV 473 Movement 1



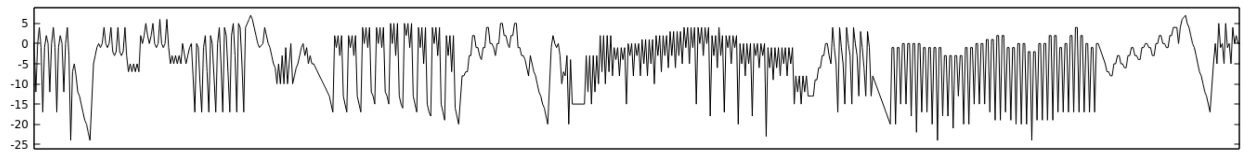
RV 473 Movement 2



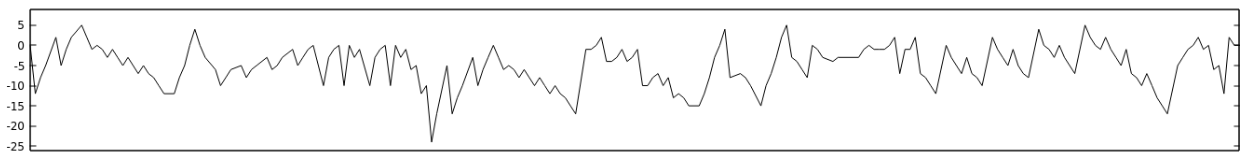
RV 473 Movement 3



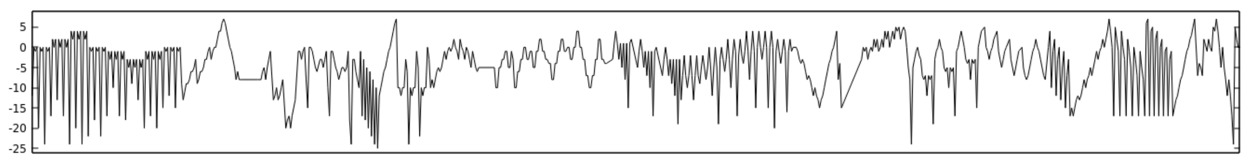
RV 477 Movement 1



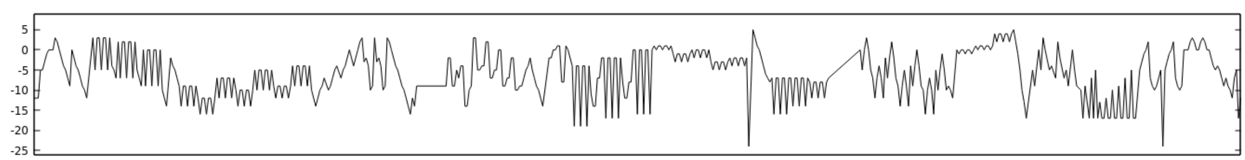
RV 477 Movement 2



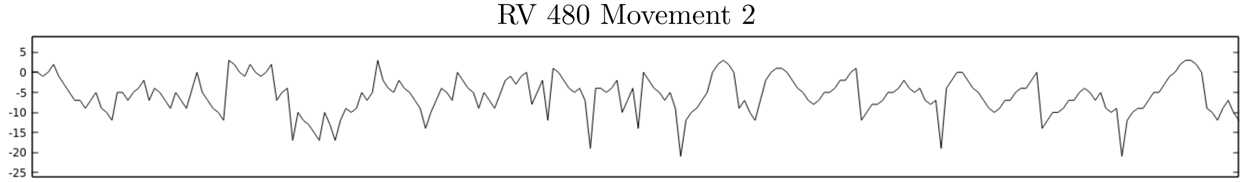
RV 477 Movement 3



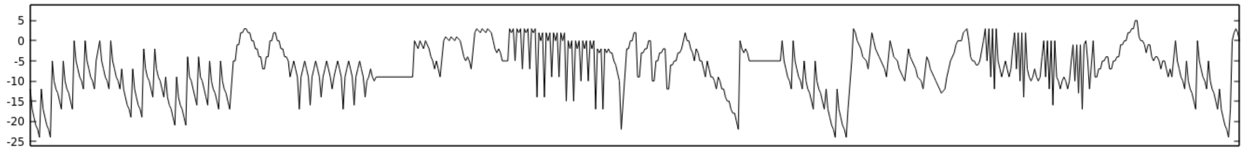
RV 480 Movement 1



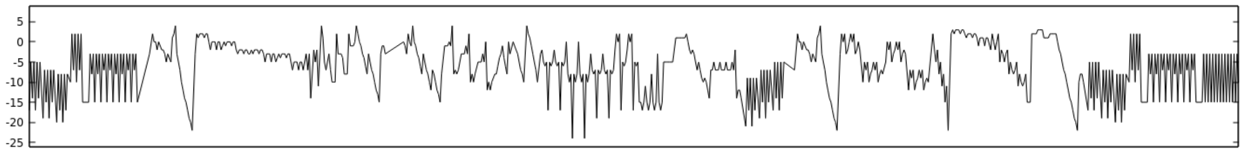
RV 480 Movement 2



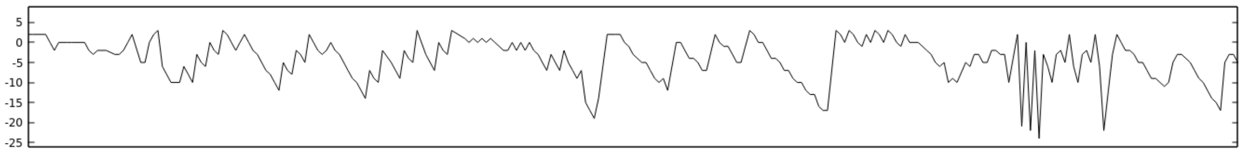
RV 480 Movement 3



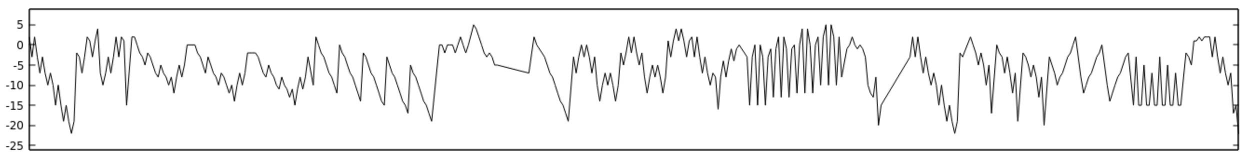
RV 481 Movement 1



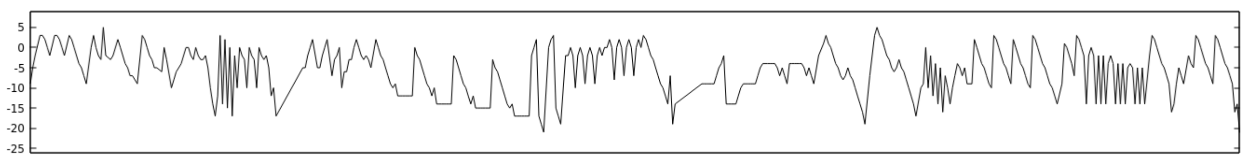
RV 481 Movement 2



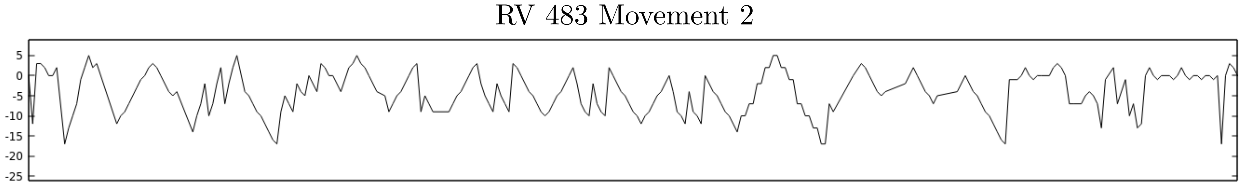
RV 481 Movement 3



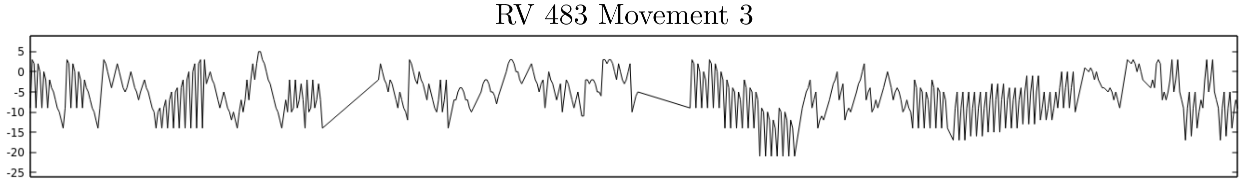
RV 483 Movement 1



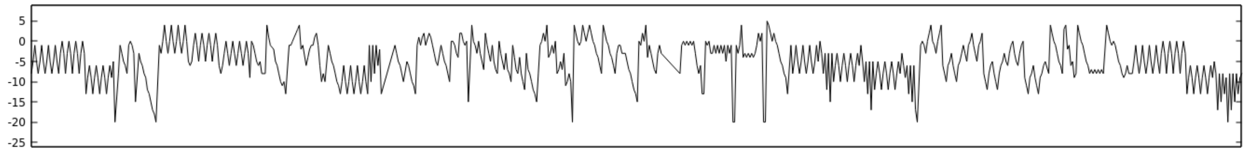
RV 483 Movement 2



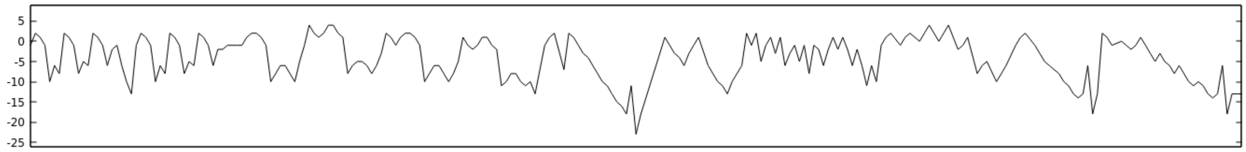
RV 483 Movement 3



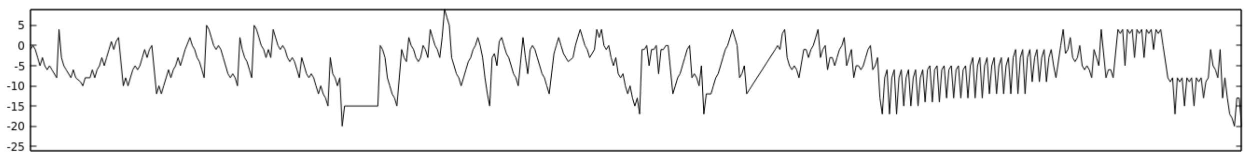
RV 484 Movement 1



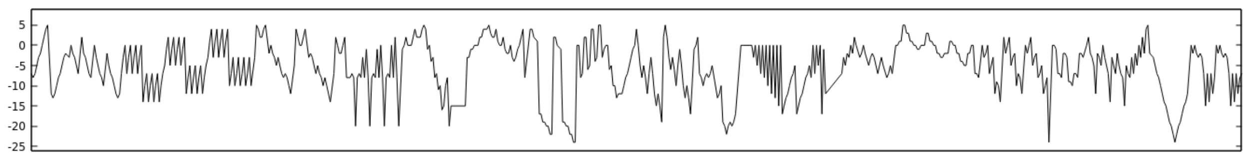
RV 484 Movement 2



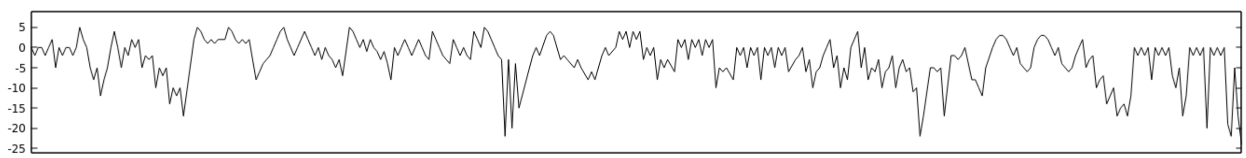
RV 484 Movement 3



RV 485 Movement 1



RV 485 Movement 2



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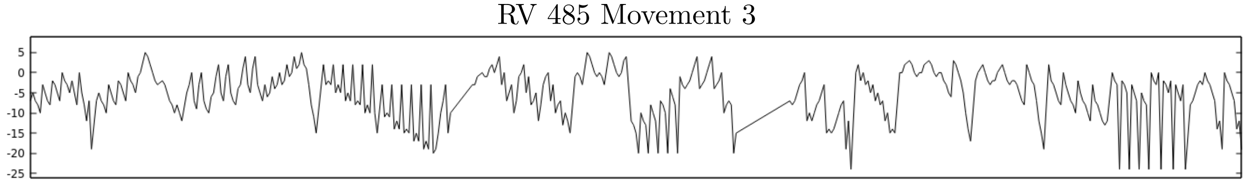
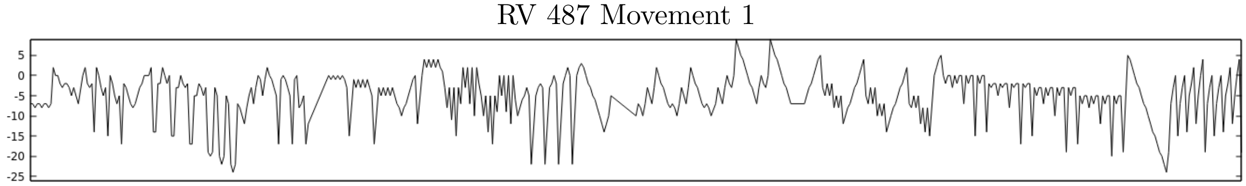


RV 487 Movement 1



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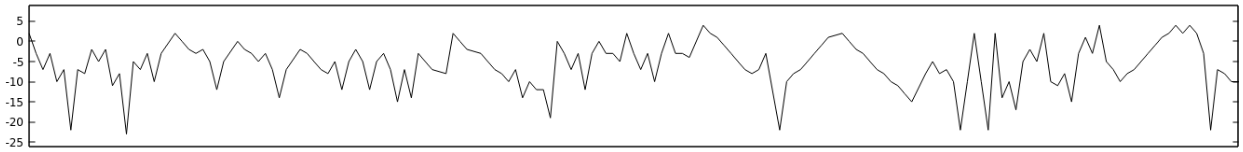
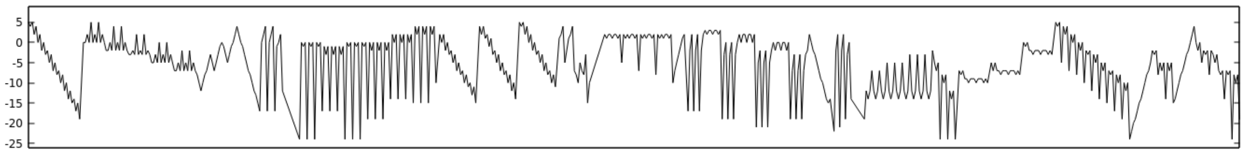


RV 487 Movement 3



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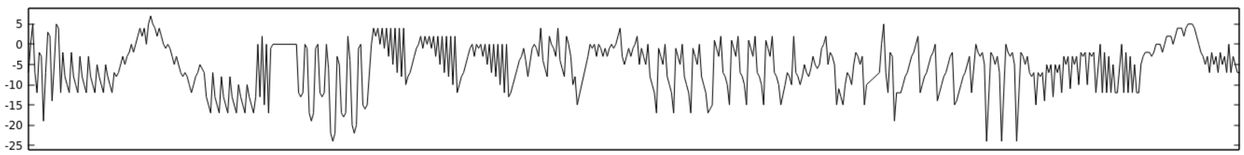

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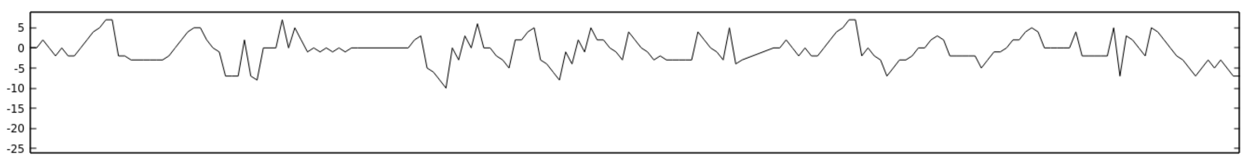

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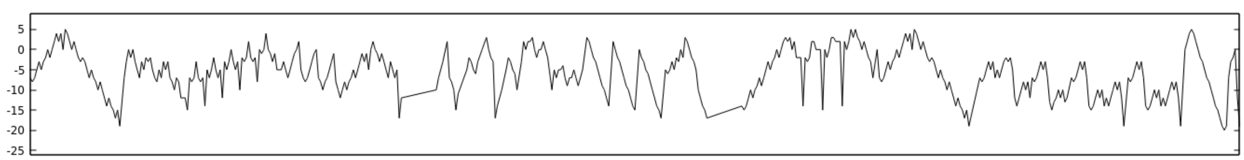
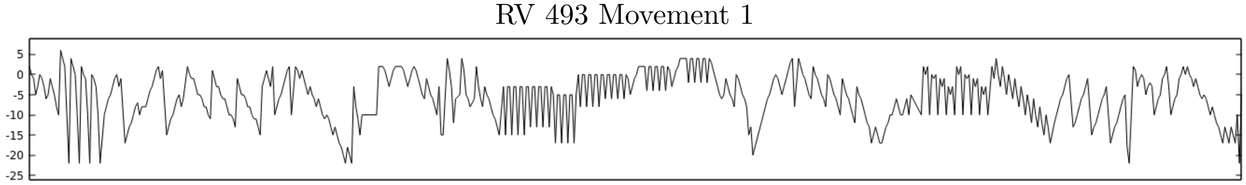
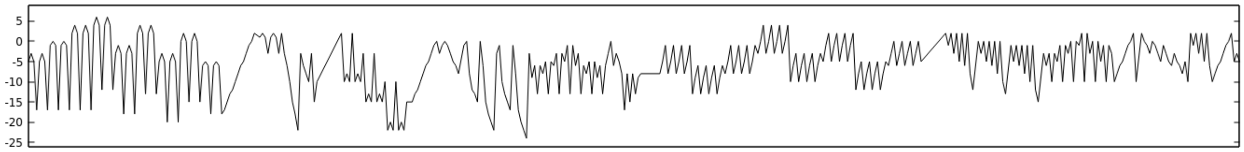


RV 493 Movement 1



RV 493 Movement 2

RV 493 Movement 3



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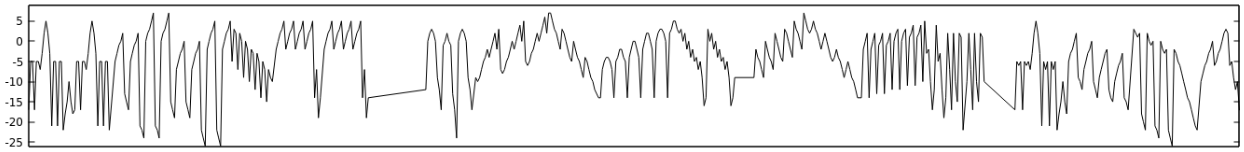

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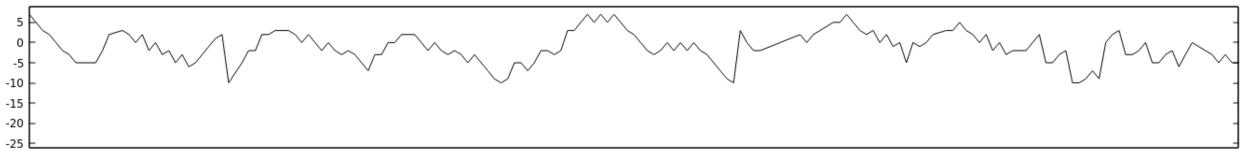

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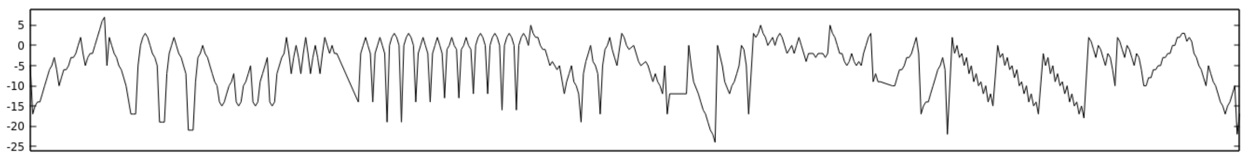

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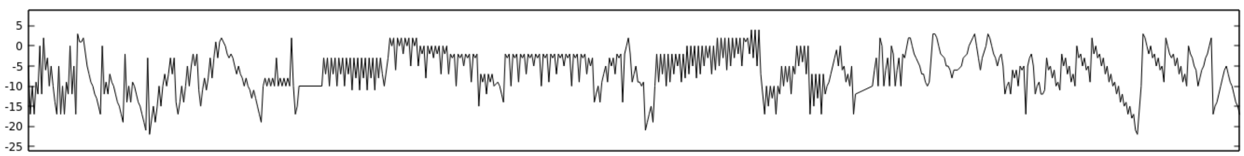

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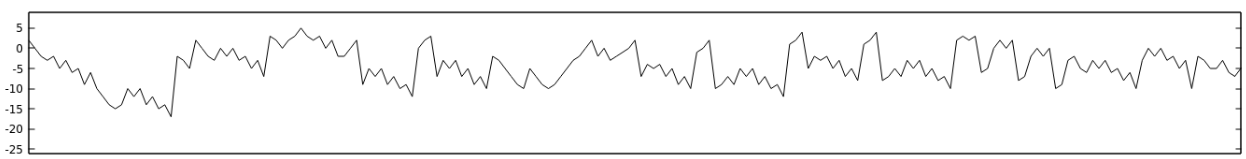

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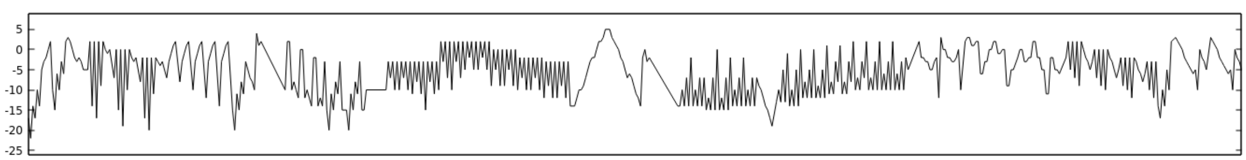

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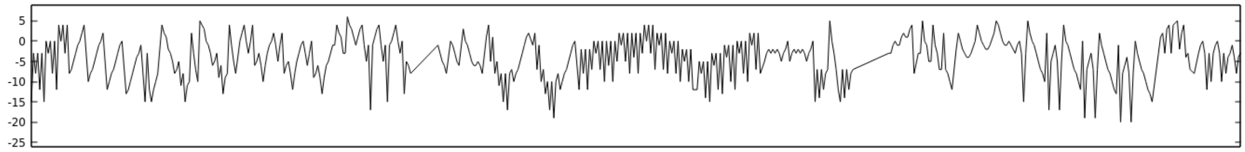

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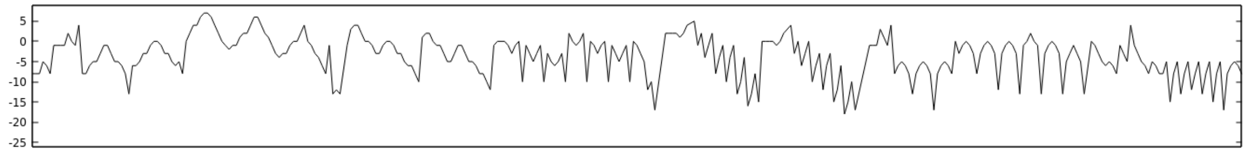

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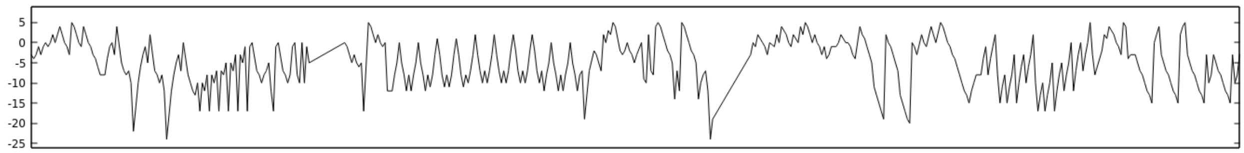

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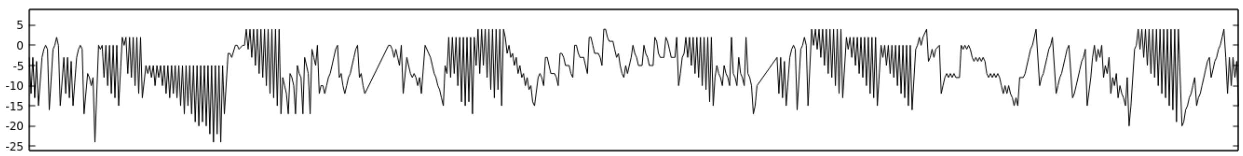

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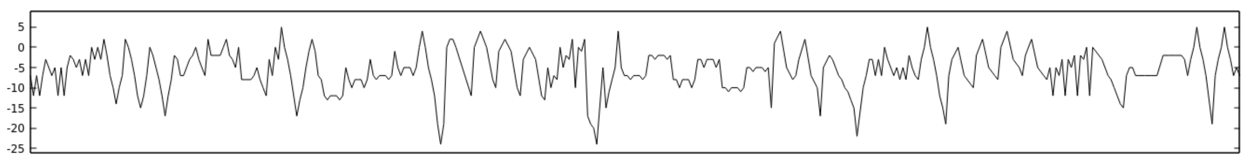

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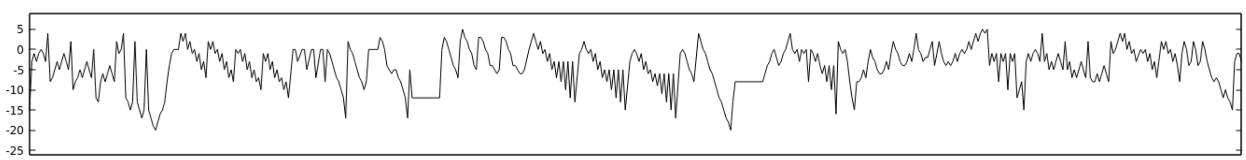

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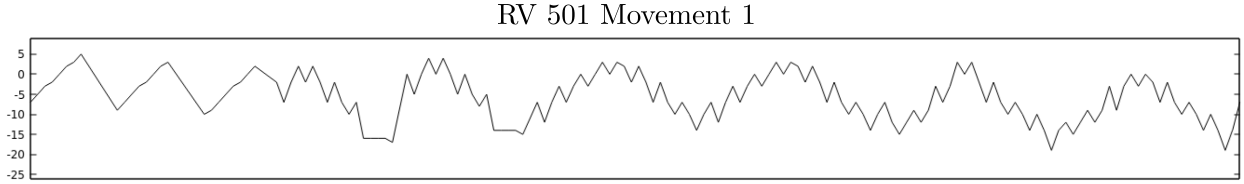

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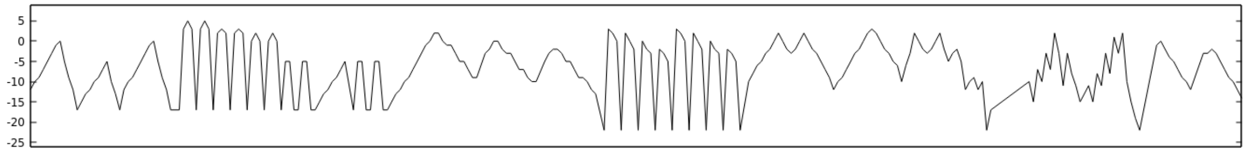

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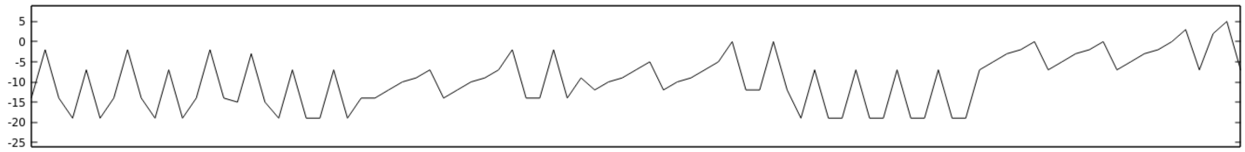

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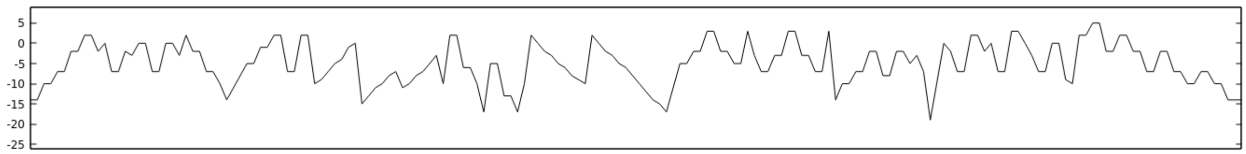

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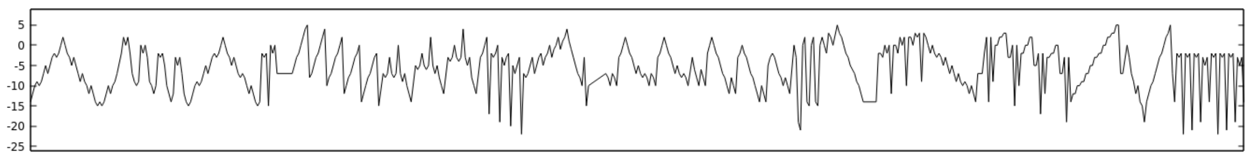

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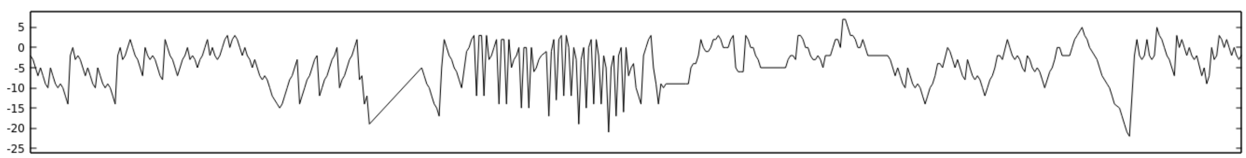

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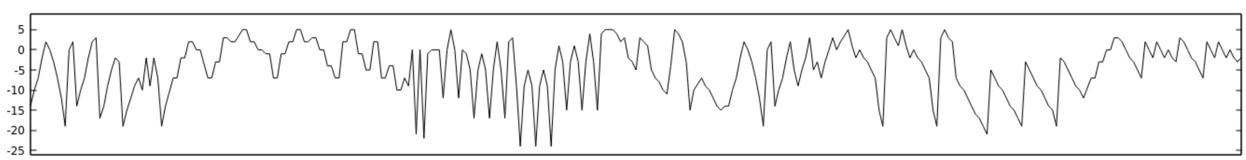

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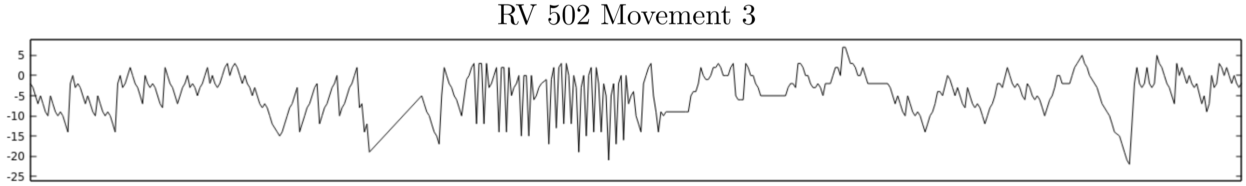

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