Rhytmische Analyse2

January 11, 2025

[1]:
```
from music21 import stream, meter, converter
```

[2]:
```
def Taktart_Analyse(score):
    """
    Bestimmung der Taktart eines Musikstücks:
    Dreier-Takt, Zweier-Takt oder gemischten Takt
    """
    if not isinstance(score, (stream.Score, stream.Part)):
        raise ValueError("Input must be a music21 stream.Score or stream.Part")

    time_signatures = score.flatten().getElementsByClass(meter.TimeSignature)

    for ts in time_signatures:
        numerator = ts.numerator
        if numerator % 3 == 0:
            return "Dreier-Takt"    #"Wenn der Zähler durch 3 ist, wird␣
 ↪'Dreier-Takt' rückgegeben."
        elif numerator % 2 == 0:
            return "Zweier-Takt"     #"Wenn der Zähler durch 2 ist, wird␣
 ↪'Dreier-Takt' rückgegeben."

    return "gemischter Takt"  #"Wenn der Zähler weder durch 3 noch durch 2␣
 ↪teilbar ist, wird 'gemischter Takt' ausgegeben."
```

[3]:
```
#test
file_path = r'C:\Users\Administrator\Desktop\Dissonanzanalyse\Sinfonia 2 BWV788.
 ↪Musicxml'
score = converter.parse(file_path)
result = Taktart_Analyse(score)
print("Taktart:", result)
```

```
Taktart: Dreier-Takt
```

[4]:
```
def Grundrhythmus_jederStimme(file_path):
    """
     Erkenne für jeden Takt und jede Stimme die am häufigsten vorkommende␣
 ↪Notentyp
```

```
     und definiere diese als den grundlegenden rhythmischen Typ für die␣
↪jeweilige Stimme in diesem Takt.
     Schließlich füge diesen Typ als Liedtext zu jedem Takt der Partitur hinzu.
     Diese Programm kann jetzt noch die Partitur bearbeiten, in der jede Stimme␣
↪eine selbsttändige Notenzeile belegt.

    """
    score = converter.parse(file_path)

    for part in score.parts:
        for measure in part.getElementsByClass(stream.Measure):
            note_durations = {}
            for element in measure.notesAndRests:
                dur_type = element.duration.type
                if dur_type not in note_durations:
                    note_durations[dur_type] = 0
                note_durations[dur_type] += 1

            # für jeden Takt und jede Stimme die am häufigsten vorkommende␣
↪Notentyp herausfinden
            if note_durations:
                most_common_duration = max(note_durations, key=note_durations.
↪get)
            else:
                most_common_duration = "unknown"

            # diesen Grundrhythmus-Typ als Liedtext zu jeder Stimme in jedem␣
↪Takt der Partitur hinzufügen
            if len(measure.notesAndRests) > 0:
                first_element = measure.notesAndRests[0]
                first_element.addLyric(most_common_duration)

    return score
```

[5]:

```
#test: Grundrhythmus_jederStimmen
```

[6]:

```
def Stimmeanzahl__jedesTakt(score):
    """
    Beurteilung, wie viele Stimmen jeder Takt hat.

    """
    measures_part_count = {}

    for measure_number, measure in enumerate(score.parts[0].
↪getElementsByClass(stream.Measure), start=1):
        part_count = 0
        for part in score.parts:
            if measure_number in [m.measureNumber for m in part.
↪getElementsByClass(stream.Measure)]:
                part_count += 1

        measures_part_count[measure_number] = part_count

    return measures_part_count
```

[7]:

```
#test
result = Stimmeanzahl__jedesTakt(score)
print(result)
```

```
{1: 2, 2: 2, 3: 2, 4: 2, 5: 2, 6: 2, 7: 2, 8: 2, 9: 2, 10: 2, 11: 2, 12: 2, 13:
2, 14: 2, 15: 2, 16: 2, 17: 2, 18: 2, 19: 2, 20: 2, 21: 2, 22: 2, 23: 2, 24: 2,
25: 2, 26: 2, 27: 2, 28: 2, 29: 2, 30: 2, 31: 2, 32: 2}
```

[8]:

```
def Grundrhythmus_allerStimmen(file_path):
    """
    Im chordify-Zustand den gemeinsamen Grundrhythmus aller Stimmen für jeden␣
↪Takt bestimmen.
    """

    chordified_score = score.chordify()
    is_three_based = Taktart_Analyse(score)

    rhythmic_patterns = []

    for measure in chordified_score.getElementsByClass(stream.Measure):
        note_durations = {}

        # Die Notentypen und deren Anzahl in jedem Takt sammeln
        for element in measure.notesAndRests:
            dur_type = element.duration.type
            if dur_type not in note_durations:
                note_durations[dur_type] = 0
            note_durations[dur_type] += 1

        # Für jeden Takt die am häufigsten vorkommende Notentyp herausfinden
        if note_durations:
            most_common_durations = [k for k, v in note_durations.items() if v␣
↪== max(note_durations.values())]
            # Bei Dreiertakt und gleich häufigen Noten wird die längere Note␣
↪gewählt
            if is_three_based and len(most_common_durations) > 1:
                most_common_duration = max(most_common_durations, key=lambda d:␣
↪duration.convertTypeToQuarterLengths(d))
```

```python
            else:
                most_common_duration = most_common_durations[0]
        else:
            most_common_duration = "unknown"

        # Rückgabe
        rhythmic_patterns.append((measure.measureNumber, most_common_duration))

    # Ausgabe
    for measure_number, rhythm in rhythmic_patterns:
        print(f"Measure {measure_number}: {rhythm}")

    # Das Ergebnis in die ursprünglichen Partitur hinzufüge
    for measure_number, rhythm in rhythmic_patterns:
        measure = score.parts[1].measure(measure_number)
        if measure and len(measure.notesAndRests) > 0:
            first_element = measure.notesAndRests[0]
            first_element.addLyric(rhythm)

    return score
```

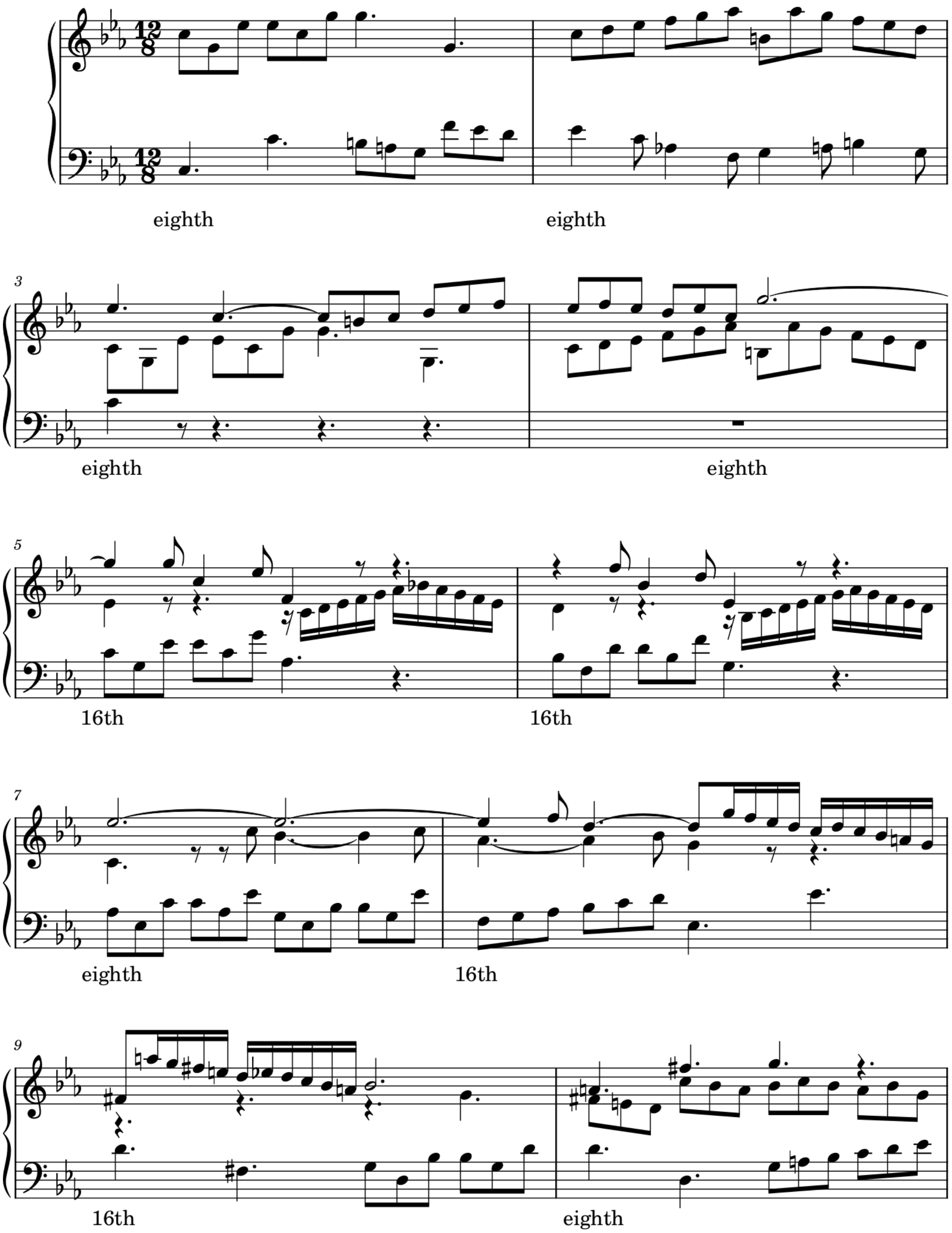
[9]:

```python
#test
score_with_rhythmic_patterns = Grundrhythmus_allerStimmen(file_path)
score_with_rhythmic_patterns.show()
```

```
Measure 1: eighth
Measure 2: eighth
Measure 3: eighth
Measure 4: eighth
Measure 5: 16th
Measure 6: 16th
Measure 7: eighth
Measure 8: 16th
Measure 9: 16th
Measure 10: eighth
Measure 11: eighth
Measure 12: eighth
Measure 13: eighth
Measure 14: 16th
Measure 15: 16th
Measure 16: eighth
Measure 17: 16th
Measure 18: 16th
Measure 19: 16th
Measure 20: 16th
Measure 21: 16th
Measure 22: 16th
Measure 23: 16th
Measure 24: 16th
Measure 25: 16th
Measure 26: 16th
Measure 27: eighth
Measure 28: 16th
Measure 29: 16th
Measure 30: eighth
Measure 31: 16th
Measure 32: 16th
```

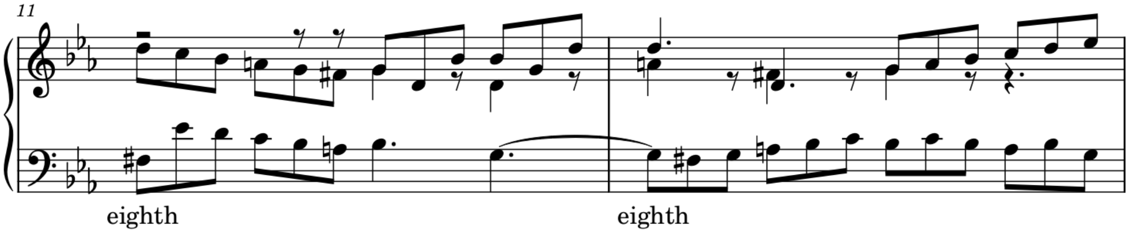
Sinfonia 2. BWV788

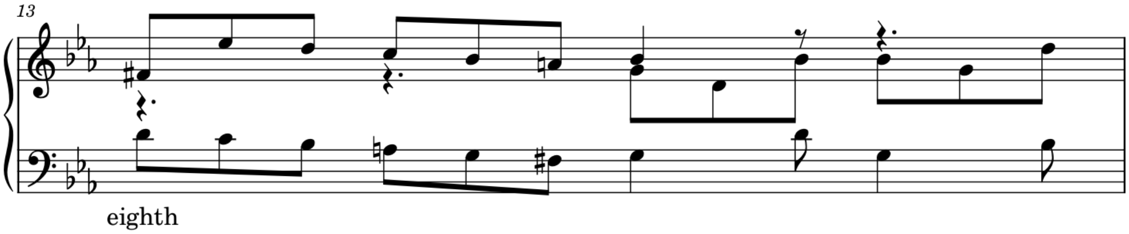
J.S.Bach

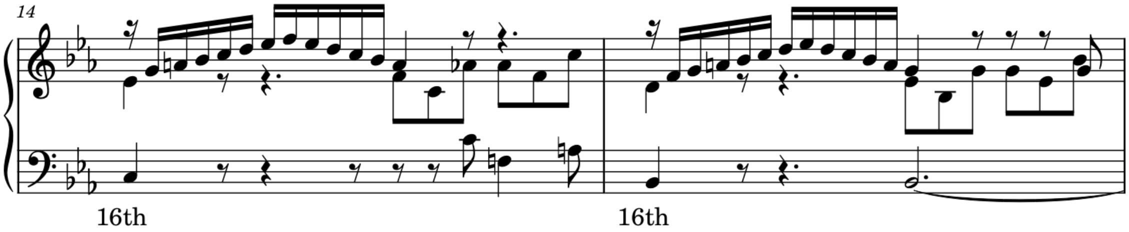


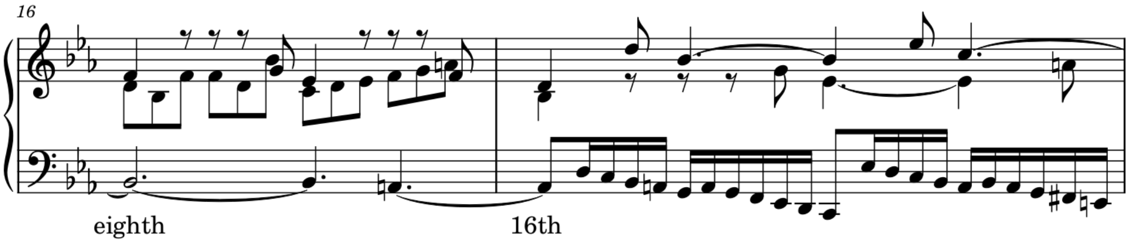
```
<IPython.core.display.HTML object>
```

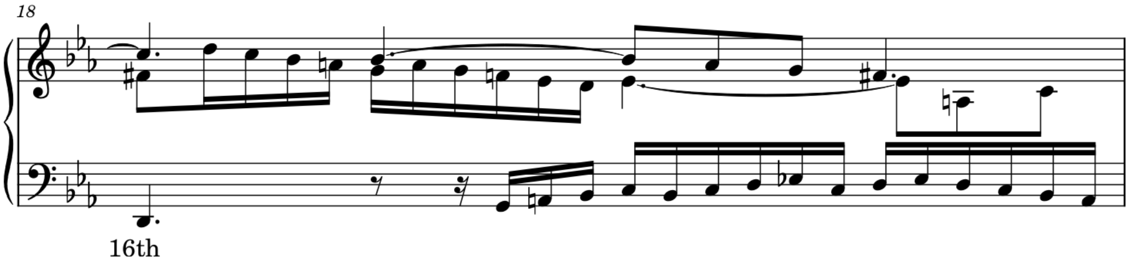
2


11
eighth
eighth

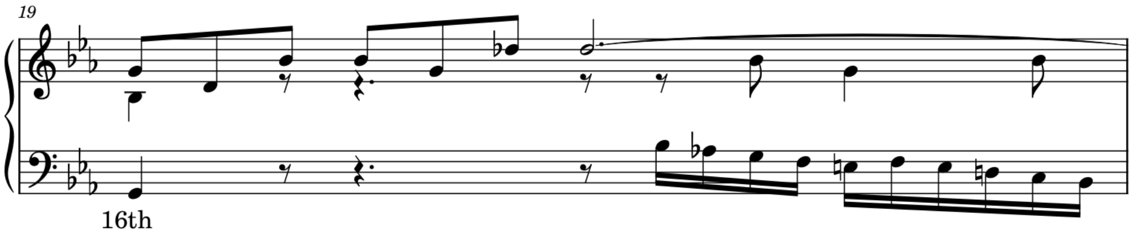

13
eighth

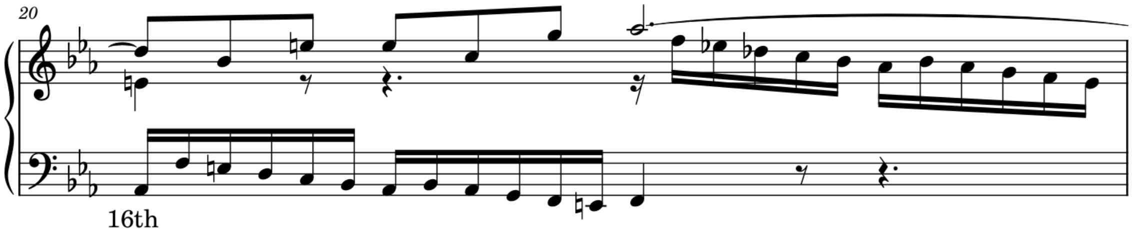

14
16th
16th

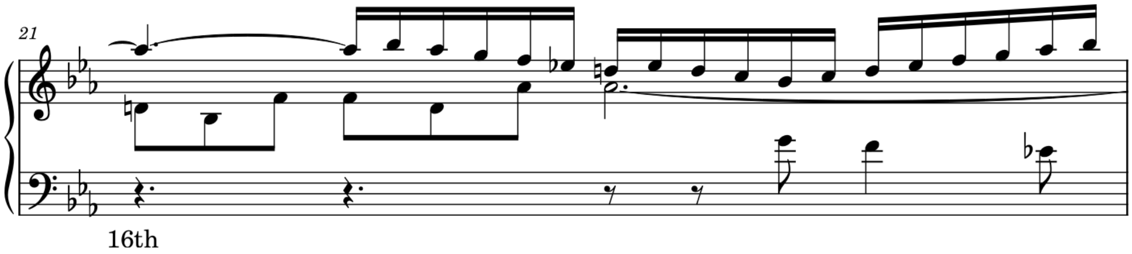

16
eighth
16th


18
16th

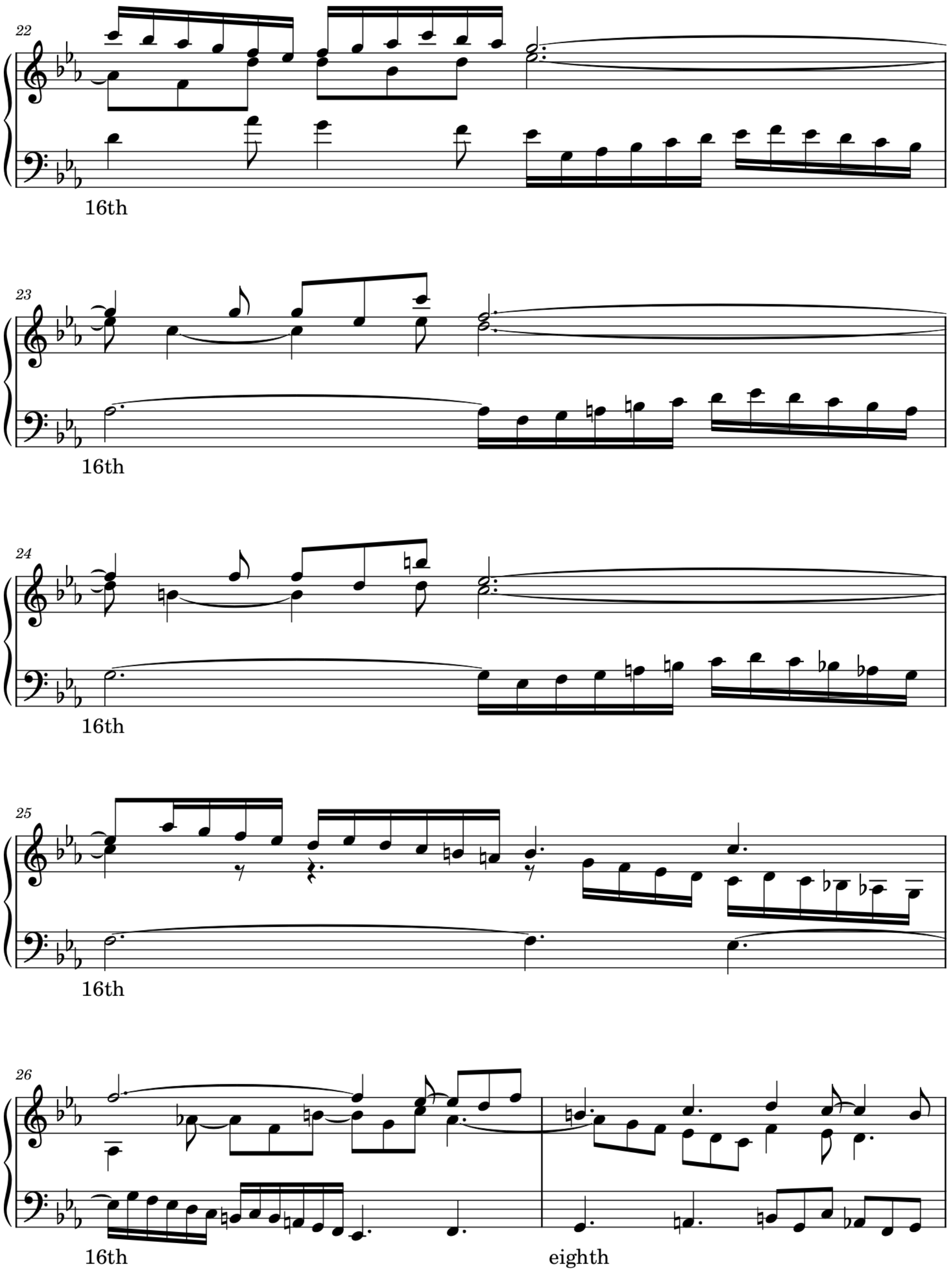
```
<IPython.core.display.HTML object>
```


19
16th

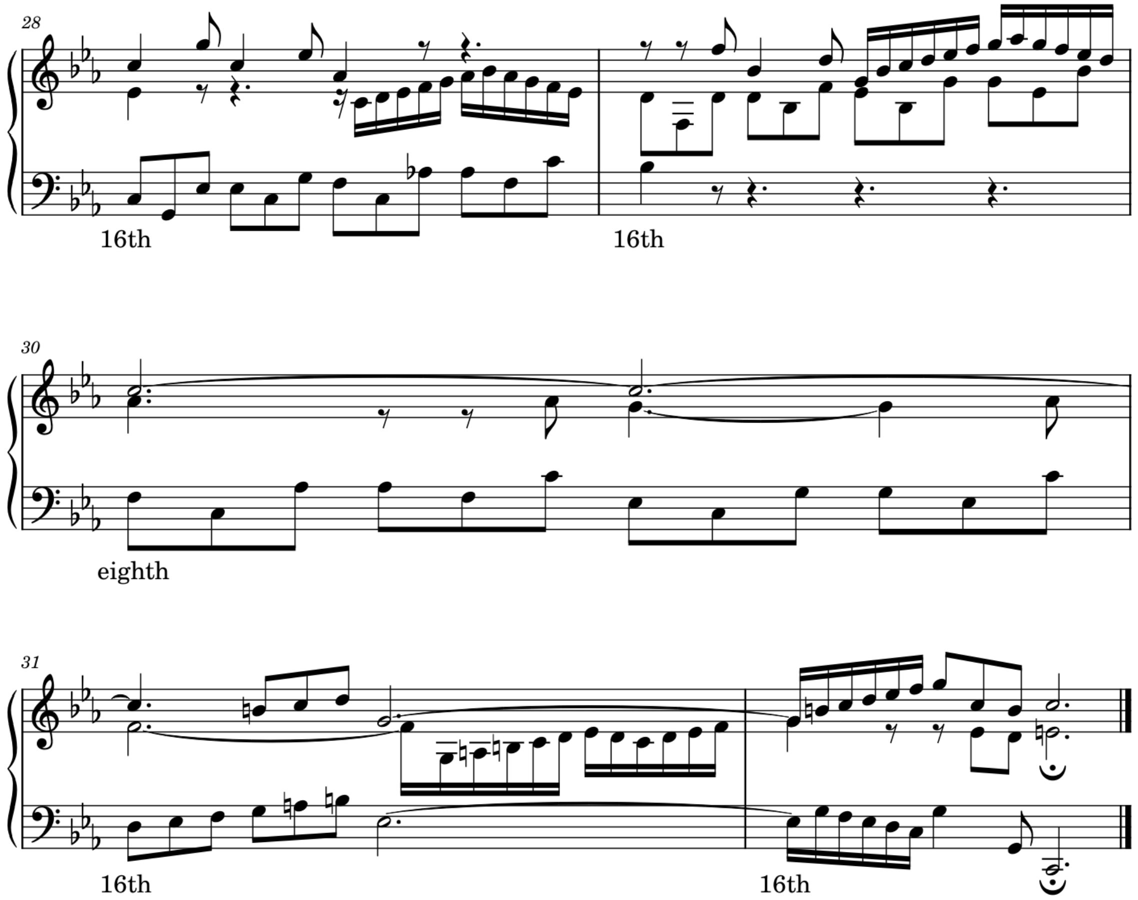

20
16th


21
16th

```
<IPython.core.display.HTML object>
```


22
16th
23
16th
24
16th
25
16th
26
16th
eighth

```
<IPython.core.display.HTML object>
```



[10]:

```python
from music21 import duration

def GrundrhythmusallerStimmen_dict(score):
    """
    in Form von dict. der gemeinsame Grundrhythmus jedes Takts zurückgegeben.
    Rückgabewert:
    dict: {Taktnummer: Rhythmustyp}
    """

    chordified_score = score.chordify()
    rhythmic_patterns = {}

    for measure in chordified_score.getElementsByClass(stream.Measure):
        measure_number = measure.measureNumber
        note_durations = {}
        for element in measure.notesAndRests:
            dur_type = element.duration.type
            if dur_type not in note_durations:
                note_durations[dur_type] = 0
            note_durations[dur_type] += 1


        if note_durations:

            most_common_durations = [
                k for k, v in note_durations.items() if v == max(note_durations.
 ↪values())
            ]


            most_common_duration = max(
                most_common_durations,
                key=lambda d: duration.Duration(type=d).quarterLength
            )
        else:

            most_common_duration = "unknown"

        rhythmic_patterns[measure_number] = most_common_duration

    return rhythmic_patterns
```

[11]:

```
import numpy as np

def Bestimme_betontePosition(score):
    """
    Diese Funktion kann basierend auf den verschiedenen Taktarten und␣
 ↪Grundrhytmus-Musteren die betonten Positionen jedes Takts bestimmen.
    Rückgabewert: dict: Die betonten Positionen jedes Takts im Format␣
 ↪{Taktnummer: [Offsets]}."
    """

    part1 = score.parts[1]
    taktart = Taktart_Analyse(score)
    grundrhythmus = GrundrhythmusallerStimmen_dict(score)

    betontePositionen = {}

    # Überprüfung des Durchlaufs des jeden Takts in Parts[1]
    for measure in part1.getElementsByClass(stream.Measure):
        measure_number = measure.measureNumber
        rhythm_type = grundrhythmus.get(measure_number, None)
        print(f"Takt {measure_number}, Grundrhythmus: {rhythm_type}")

        if rhythm_type is None:
            print(f"Takt {measure_number}: nichts")
            continue
        if measure.duration is None:
            print(f"Takt {measure_number}: keine Dauerangabe")
            continue

        # Logik für Zweiertakt
        if taktart == "Zweier-Takt":
            # jede 4tel-Note als betonte Position
            if rhythm_type in ["32th", "16th", "eighth"]:
                strong_beats = [offset for offset in range(0, int(measure.
↪duration.quarterLength), 1)]
            # jede Halbnote als betonte Position
            elif rhythm_type == "quarter":
                strong_beats = [offset for offset in range(0, int(measure.
↪duration.quarterLength), 2)]
            # jede Ganznote als betonte Position
            elif rhythm_type in ["half", "whole"]:
                strong_beats = [offset for offset in range(0, int(measure.
↪duration.quarterLength), 4)]
            # Breve als betonte Position
            else:
                strong_beats = [offset for offset in range(0, int(measure.
↪duration.quarterLength), 8)]

        # Logik für Dreiertakt
        elif taktart == "Dreier-Takt":
            time_signatures = score.flatten().getElementsByClass(meter.
↪TimeSignature)
            for ts in time_signatures:
                denominator = ts.denominator

                # beim 8tel-Takt (3/8, 6/8, 9/8 usw.)
                if denominator == 8:
                    # jede punktierte 4tel-Note als betonte Position
                    if rhythm_type in ["16th", "eighth", "quarter"]:
                        strong_beats = [offset for offset in np.arange(0,␣
↪measure.duration.quarterLength, 1.5)]
                    else:
                        strong_beats = []

                # beim 16tel-Takt (12/16, usw.)
                elif denominator == 16:
                    # jede punktierte 8tel-Note als betonte Position
                    strong_beats = [offset for offset in np.arange(0, measure.
↪duration.quarterLength, 0.75)]

                # beim 4tel-Takt (3/4, 6/4, usw.)
                elif denominator == 4:
                    # jede 4tel-Note als betonte Position
                    if rhythm_type in ["16th", "eighth"]:
                        strong_beats = [offset for offset in range(0,␣
↪int(measure.duration.quarterLength), 1)]
                    # jede punktierte Halbnote als betonte Position
                    elif rhythm_type in ["quarter", "half"]:
                        strong_beats = [offset for offset in range(0,␣
↪int(measure.duration.quarterLength), 3)]
                    else:
                        strong_beats = []

                # beim 2tel-Takt (3/2, usw.)
                elif denominator == 2:
                    # jede Halbnote als betonte Position
                    if rhythm_type in ["eighth", "quarter"]:
                        strong_beats = [offset for offset in range(0,␣
↪int(measure.duration.quarterLength), 2)]
                    # jede punktierte Ganznote als betonte Position
                    elif rhythm_type in ["half", "whole"]:
                        strong_beats = [offset for offset in range(0,␣
↪int(measure.duration.quarterLength), 6)]
                    else:
                        strong_beats = []

                else:
                    strong_beats = []

        else:
            strong_beats = []

        betontePositionen[measure_number] = [float(offset) for offset in␣
↪strong_beats]

    return betontePositionen
```

[12]:

```
betontPositionen = Bestimme_betontePosition(score)
for measure, positions in betontPositionen.items():
    print(f"Takt {measure}, betonte Position:{positions}")
```

```
Takt 1, Grundrhythmus: eighth
Takt 2, Grundrhythmus: eighth
Takt 3, Grundrhythmus: eighth
Takt 4, Grundrhythmus: eighth
Takt 5, Grundrhythmus: 16th
Takt 6, Grundrhythmus: 16th
Takt 7, Grundrhythmus: eighth
Takt 8, Grundrhythmus: 16th
Takt 9, Grundrhythmus: 16th
Takt 10, Grundrhythmus: eighth
Takt 11, Grundrhythmus: eighth
Takt 12, Grundrhythmus: eighth
Takt 13, Grundrhythmus: eighth
Takt 14, Grundrhythmus: 16th
Takt 15, Grundrhythmus: 16th
Takt 16, Grundrhythmus: eighth
Takt 17, Grundrhythmus: 16th
Takt 18, Grundrhythmus: 16th
Takt 19, Grundrhythmus: 16th
Takt 20, Grundrhythmus: 16th
Takt 21, Grundrhythmus: 16th
Takt 22, Grundrhythmus: 16th
Takt 23, Grundrhythmus: 16th
Takt 24, Grundrhythmus: 16th
Takt 25, Grundrhythmus: 16th
Takt 26, Grundrhythmus: 16th
Takt 27, Grundrhythmus: eighth
Takt 28, Grundrhythmus: 16th
Takt 29, Grundrhythmus: 16th
Takt 30, Grundrhythmus: eighth
Takt 31, Grundrhythmus: 16th
Takt 32, Grundrhythmus: 16th
Takt 1, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 2, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 3, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 4, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 5, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 6, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 7, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 8, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 9, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 10, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 11, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 12, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 13, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 14, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 15, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 16, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 17, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 18, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 19, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 20, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 21, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 22, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 23, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 24, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 25, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 26, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 27, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 28, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 29, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 30, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 31, betonte Position:[0.0, 1.5, 3.0, 4.5]
Takt 32, betonte Position:[0.0, 1.5, 3.0, 4.5]
```

[ ]: