

小提琴发声原理

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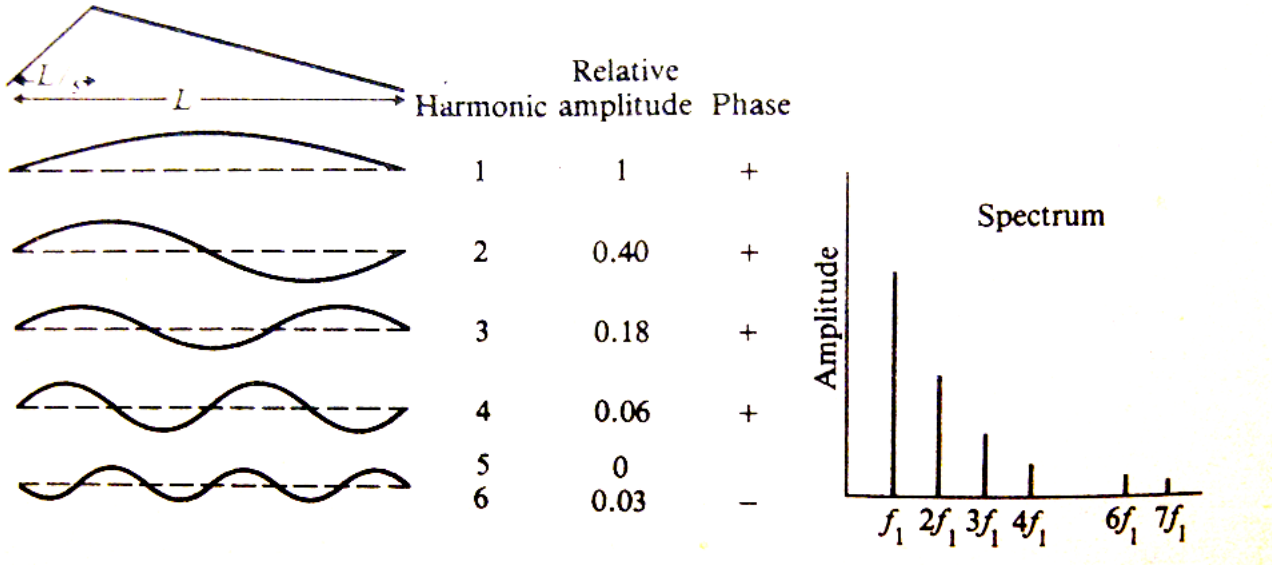
刘盖特

2012.06.20

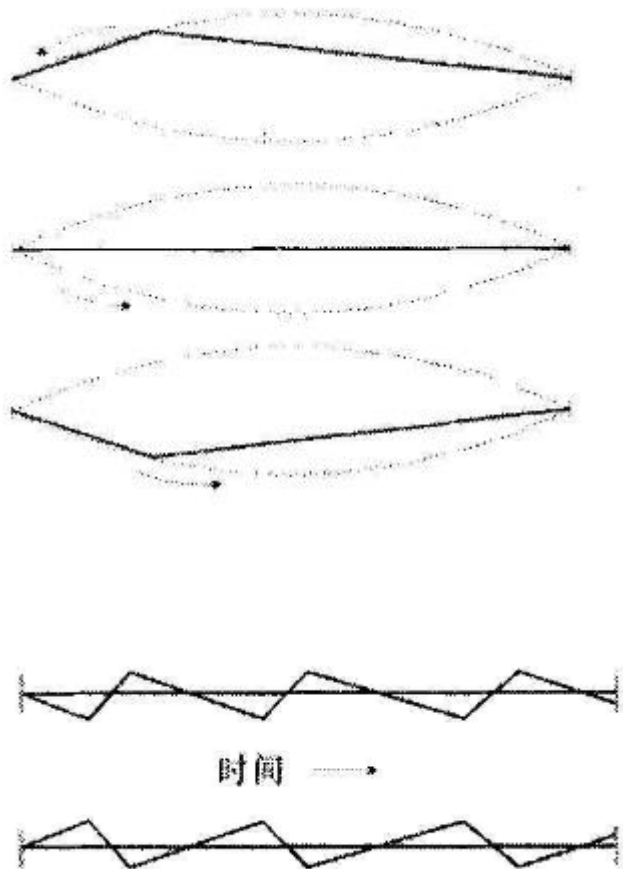
主要内容

- 原理阐述
- 小提琴的部件
- 泛音
- 和弦

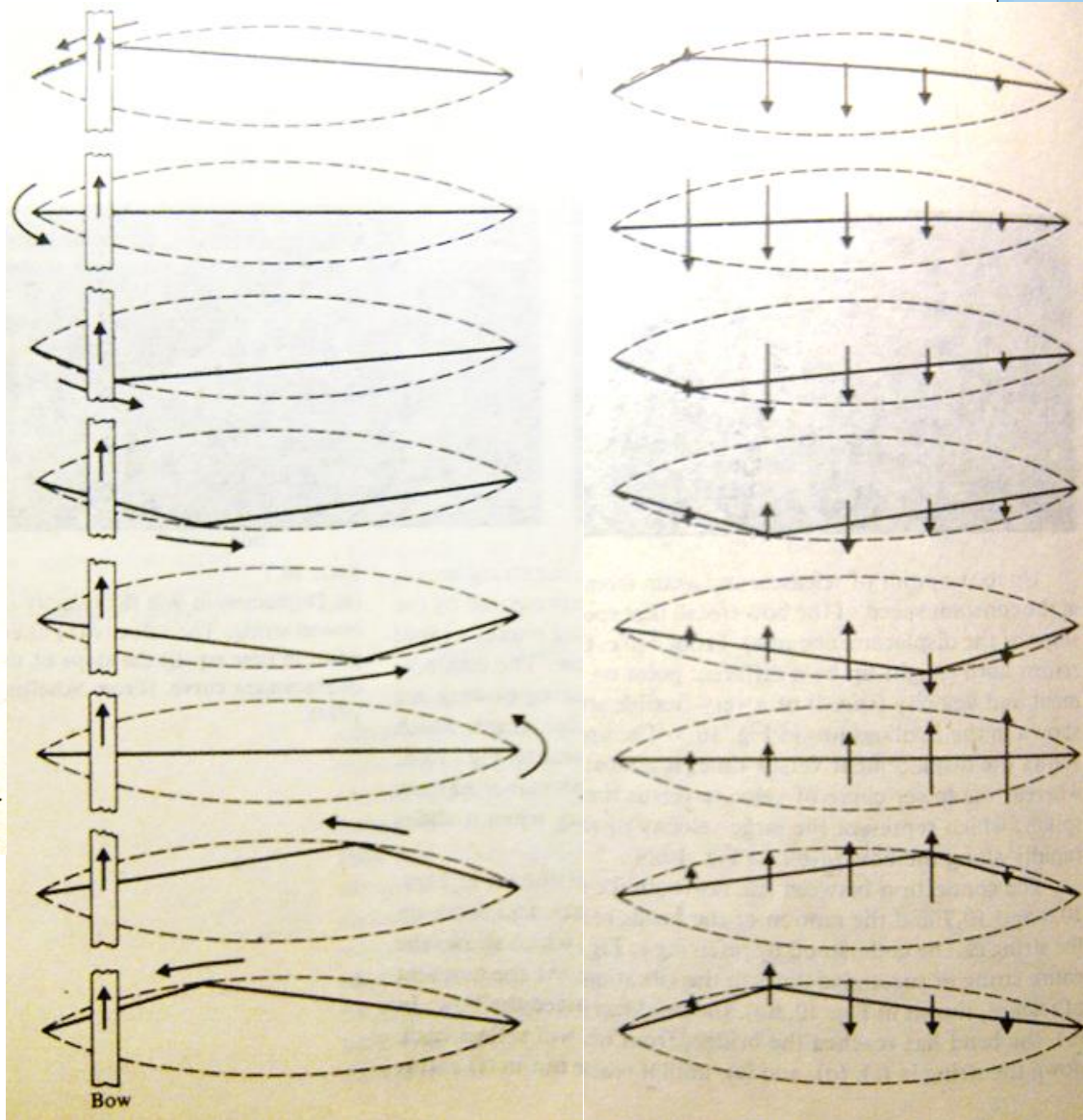
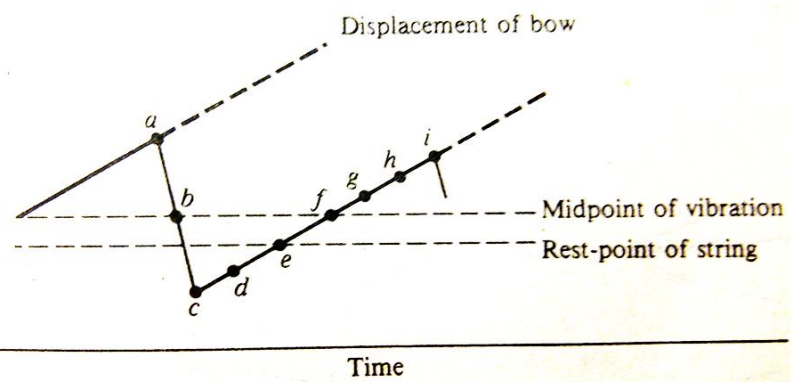
拨弦的频率与振幅



拉弦的频率与振幅



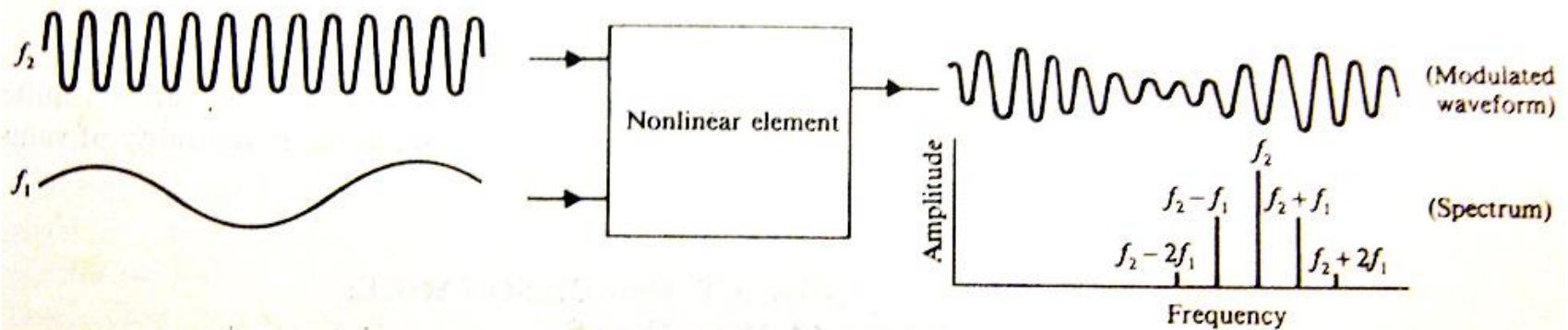
- 当一个弓子拉过弦的时候，琴弦震动呈凸透镜状，如一条光滑的带子，实际弓子下面的琴弦很接近折线状。
- 上述的这种现象不连续性从琴码处被反射回来，这并非是擦有松香的结果，而是由于运弓中弓毛与琴弦之间不断的扭结和放松。产生三角波状曲线，



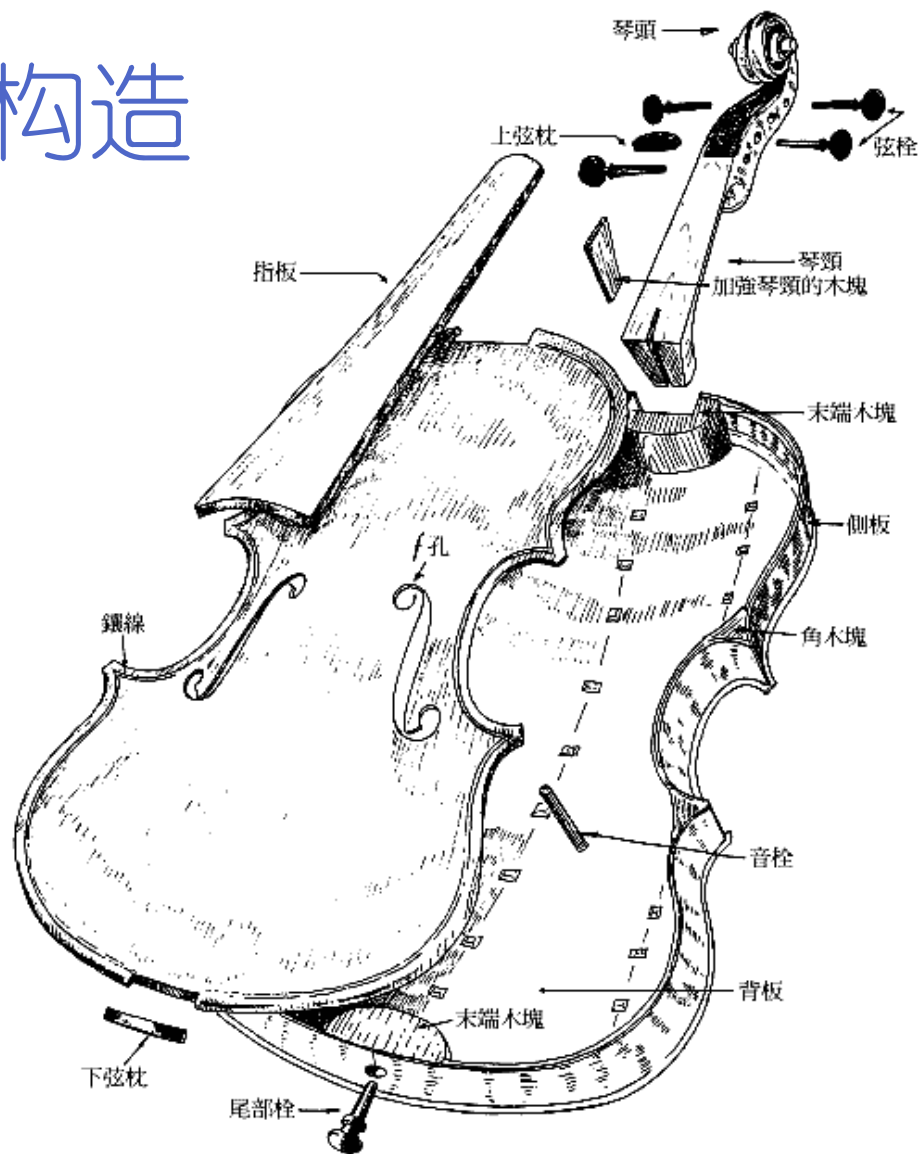
和弦频率 Combination Tones

Common difference tone

Cubic difference tone



小提琴的构造



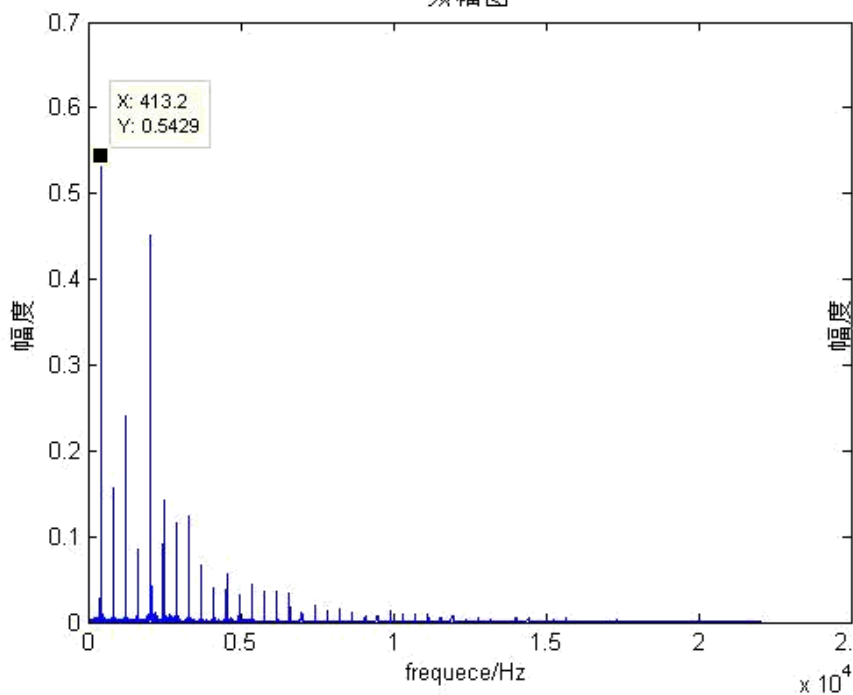
低音梁



自然泛音

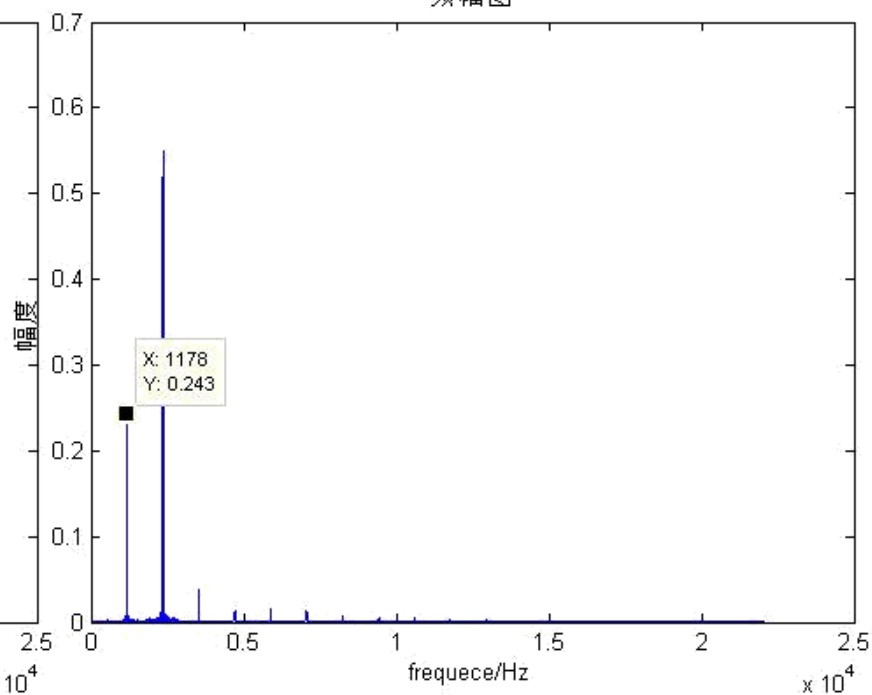
D弦g1处基音

频幅图



D弦g1处泛音

频幅图



为什么呢？

- D弦空弦时的音：
d1——293.7Hz
- g1——392.0Hz 1178Hz

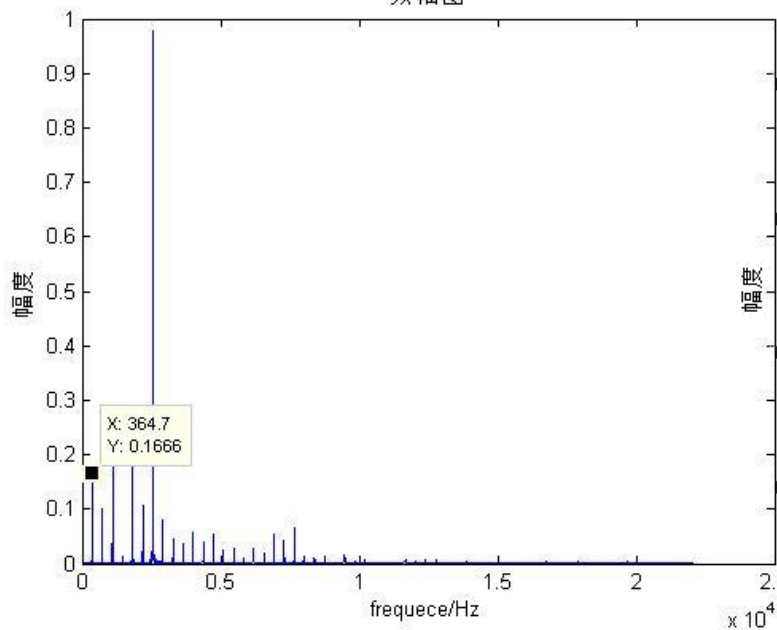
- $f_T = \frac{v}{\lambda} = \frac{nv}{2L} = \frac{n}{2L} \sqrt{\frac{F}{\mu}}$

- $293.7/392.0 \approx 3/4$
- $293.7/1178 \approx 1/4$

人工泛音

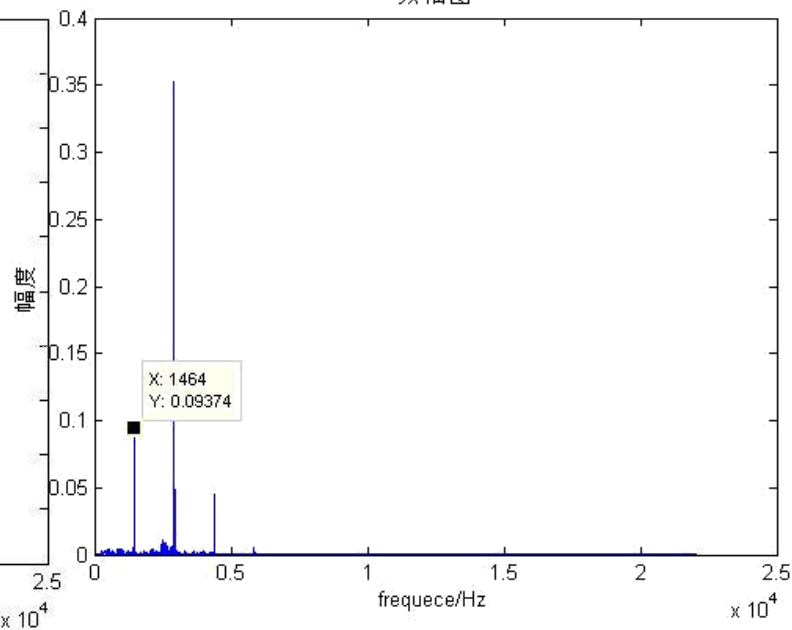
D弦#f1处基音

频幅图



D弦#f1+b1泛音

频幅图



○ #f1——370.0 Hz

○ b1——493.9 Hz

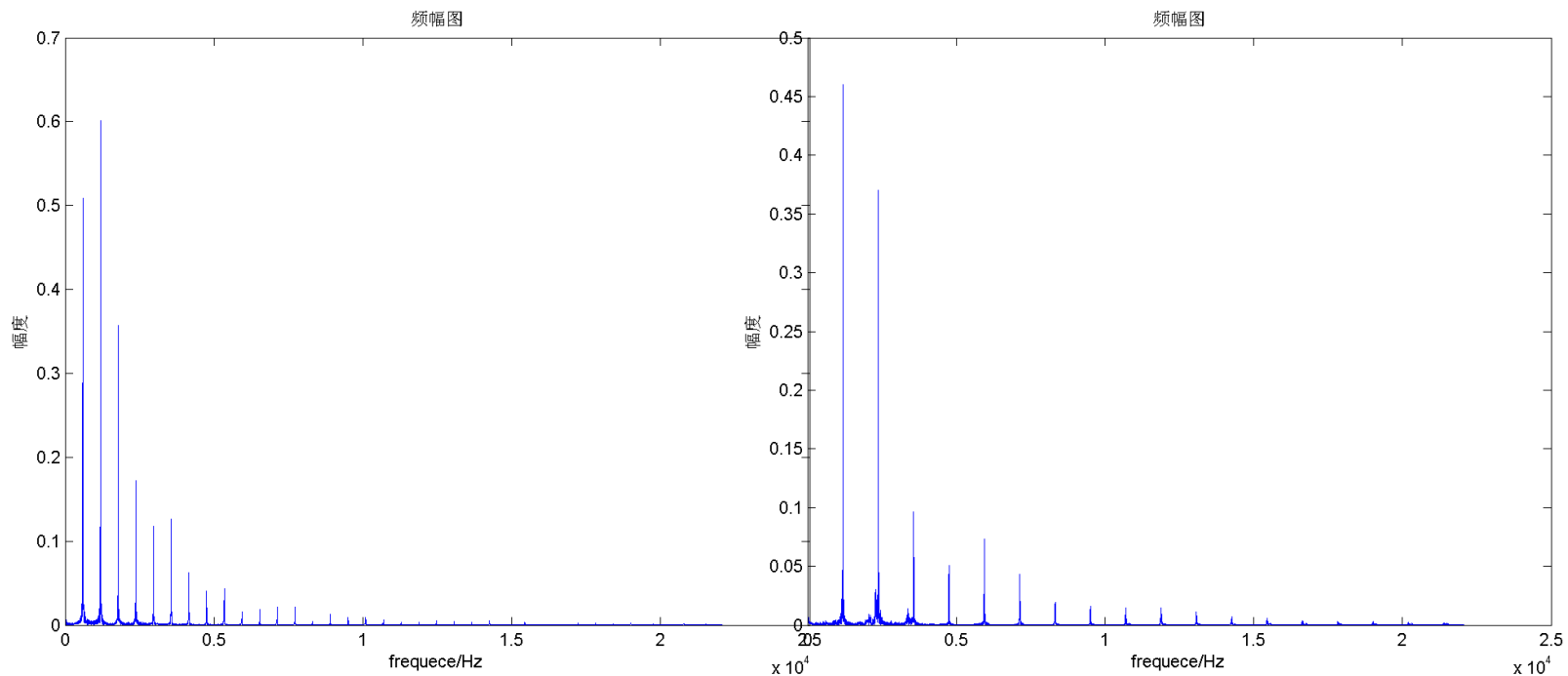
○ $370.0/493.9 \approx 3/4$

○ $370.0/1464 \approx 1/4$

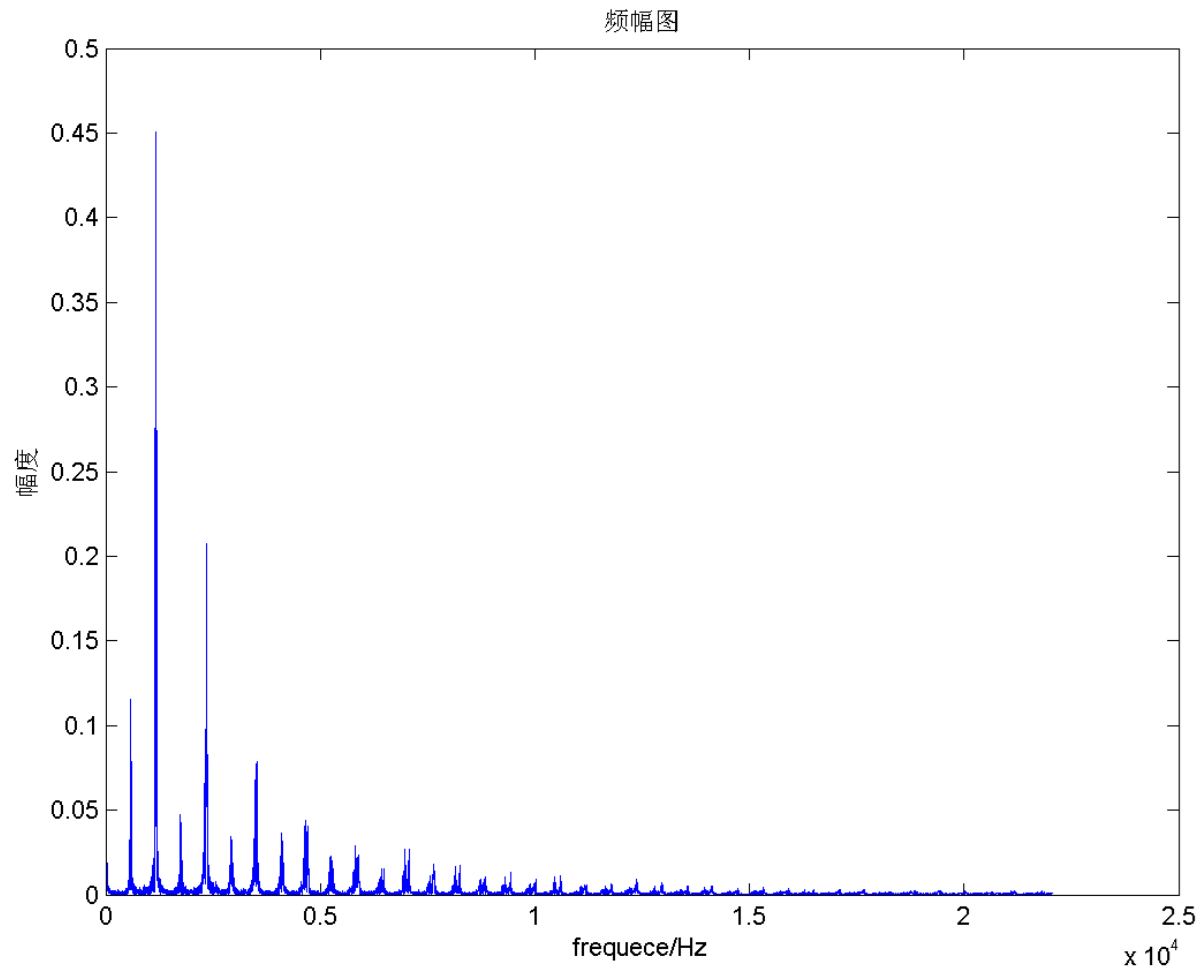
和弦

d2 594Hz

d3 1188Hz

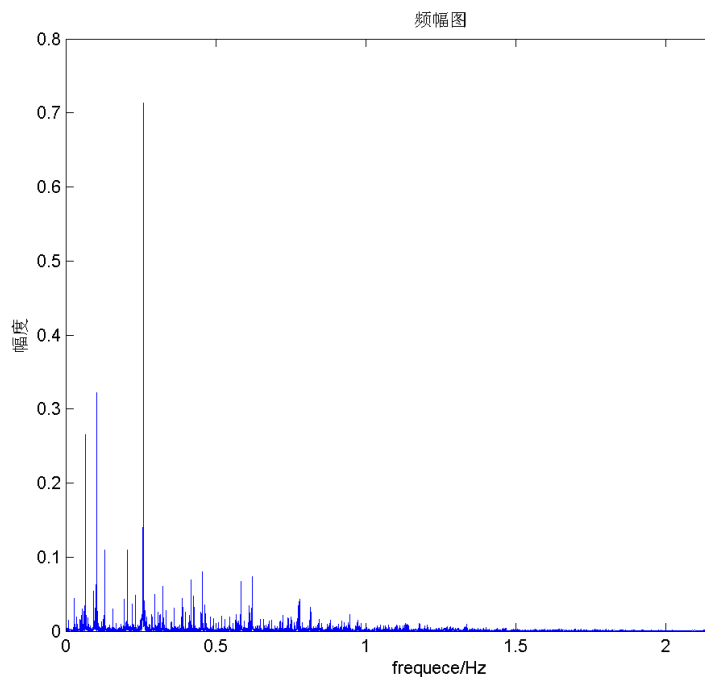


d2&d3

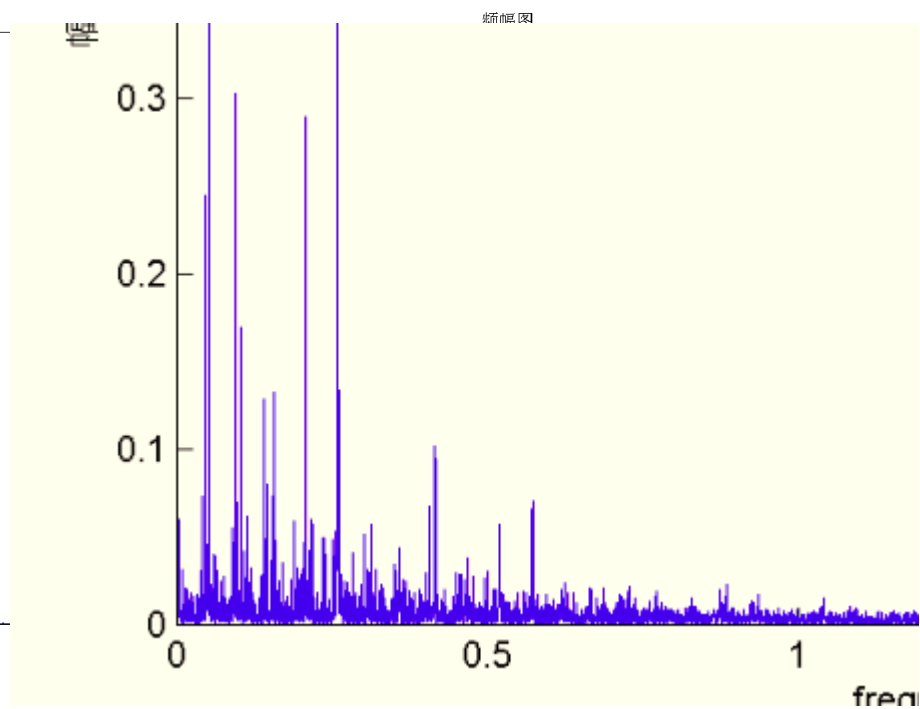


和弦的比较

c2&e1



c2&b1



参考文献

- 《从提琴制作的声学原理浅谈合理运弓的教学应用》 靳婉宜
- 《The Science Of Sound》 THOMAS D. ROSSING

特别鸣谢



谢谢大家！