Musical tonality and nonlinear dynamics

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Summary. The current study is motivated by some observations of highly nonlinear dynamical effects in biological auditory systems. We examine the hypothesis that one of the underlying mechanisms responsible for the observed nonlinearity is self-excited oscillation (SEO). According to this hypothesis the detection and processing of input audio signals by biological auditory systems is performed by coupling the input signal with an internal element undergoing SEO. Under appropriate conditions such coupling may result in synchronization between the input signal and the SEO. In this talk I will present some supporting evidence for this hypothesis by showing that some well-known phenomena in musical tonality can be explained by the Hopf model of SEO and the Arnold model of synchronization. Moreover, some mathematical properties of these models are employed as guidelines for the construction of some modulations that can be applied to a given musical composition. The construction of some intriguing patterns of musical harmony is demonstrated by applying these modulations to known musical pieces [1].

References

[1] https://buks.net.technion.ac.il/MuH/