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(UG*) (POS-36) Noisy Nonlinear Dynamics of Otoacoustic Emissions

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Healthy ears are not only sensitive and selective detectors of sound, but also emit faint sounds at amplitudes typically below human hearing threshold. These sounds are known as otoacoustic emissions (OAEs) and are considered a byproduct of an active nonlinear amplification process, arising from collective dynamics of the sensory hair cells in the inner ear. OAEs can occur spontaneously in the absence of any stimuli (SOAEs) and can be evoked in response to external acoustic stimuli (eOAEs). It has been established that these emissions correlate to auditory perception. However, much is unknown about OAE generation as well as the role of noise (e.g., Brownian motion of the fluids in the inner ear). As well as creating a noise floor, we consider the notion that noise could contribute to improving sensitivity and/or selectivity. In order to address this, we extend an established model of coupled nonlinear oscillators (Vilfan & Duke, 2008) to simulate both SOAEs and eOAEs. In particular we examine the model's response to tones, varying both level and frequency. We look at the impact that addition of noise has to both collective and individual responses of the oscillators on the sensitivity or selectivity of the system. This model provides insight into how the dynamics of the system as a whole contrast to those of a singular part of the given system. These insights could provide more information as to how hair cells work collectively to produce OAEs.

Keyword-1

Otoacoustic emissions

Keyword-2

Nonlinear oscillators

Keyword-3

Noise

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