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Disappearance of Resonant Tongues

This work, by Rocio Ruelas and myself, investigates a phenomenon observed in systems of the form

$$dx/dt = a_1(t) \ x + a_2(t) \ y$$

$$dy/dt = a_3(t) \ x + a_4(t) \ y$$

where $a_i(t) = P_i + \epsilon \ Q_i \cos 2t$, where P_i, Q_i and ϵ are given constants,

and where it is assumed that when $\epsilon{=}0$ this system exhibits a pair of linearly independent solutions of period 2π.

Since the driver $\cos 2t$ has period π, we have the ingredients for a 2:1 subharmonic resonance, which typically results in a tongue of instability involving unbounded solutions when $\epsilon > 0$. We present conditions on the coefficients P_i, Q_i such that the expected instability does not occur, i.e., the tongue of instability has disappeared.