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Stability of a certain quasi-polynomial

The talk deals with the direct analysis of a certain transcendental quasi-polynomial arising in modelling applications. Our main concern in the analysis is the distribution of characteristic roots in a suitable parameter space. As is well-known, characterisation of root distribution is essential in the description of stability of equilibria. Since the quasi-polynomial is transcendental, it is also true that the celebrated Hermite-Routh-Hurwitz criterion is not applicable. The classical Hermite-Biehler theorem gives necessary and sufficient conditions for the Hurwitz stability of a polynomial in terms of certain interlacing conditions. Inspired by the pioneering work of N.G. Cebatarev, L.S. Pontryagin generalised the Hermite-Biehler theorem to be able to handle some transcendental quasi-polynomials. Unfortunately, there are still many problems for which Pontryagin's method of root determination simply does not work. This talk will highlight some limitations of Pontryagin's method, before proceeding to describe an alternative approach.