Root Location Analysis of Trinomial with Strictly Complex Coefficients

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The root locus is a very useful technique for design and analysis of control systems. It enables to obtain conditions for stability of control systems in an effective form. Moreover, other properties of control system can be deduced from the root locus analysis. We consider a trinomial with two strictly complex coefficients

$$T_{k,m}(\lambda) = \lambda^k + \mathrm{i}a\lambda^{k-m} + \mathrm{i}b,$$

where $a, b \in \mathbb{R}$ and $k > m$, $k, m \in \mathbb{N}$. Our aim is to analyze a dependence of a number of roots of the trinomial $T_{k,m}$ with a modulus lower than one, equal to one and greater than one on a pair of parameters (a, b). The root locus technique is utilized to obtain a location of roots with respect to the unit circle in the complex plane. A number of roots inside the unit disk is described in a relation with two parameters values. An appropriate graphics illustrates trinomial roots distribution in particular cases.