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**SYNTHESIS OF STABILIZING PID CONTROLLERS FOR BIOMECHANICAL MODELS**

**The paper presents an analysis-synthesis framework for linear time invariant systems based on the generalized Hermite-Biehler Theorem. Consider a system with PID controller which has a closed-loop characteristic polynomial. We know from Hurwitz stability analysis that 0 right-half plane roots indicate stability, to test this consider the odd and even powers of ‘s’ and verity the characteristic polynomial is Hurwitz stable. Now substituting the values of ‘jw’ in place of ‘s’ gives the *Kp* and from the velocity and integral gains we get *Kd* and *Ki*. Now Apply the Hermite-Biehler Theorem on the system such that we derive the signature of the polynomial, thereby achieve the conditions for the existence of stabilizing PID controller by the following:**

* **The Range of *Kp* for which the root distribution is satisfied can be identified by root locus plot over the upper limit and lower limit of *Kp***
* **The non-empty solution can be found over the ranges of the stabilizing gains *Ki* and *Kd* which is given by linear matrix inequalities**

**Hence, solution is given by a convex polygon or a half-plane in the *Ki* - *Kd* space for different values possible for *Kp*. Therefore, the mathematical stability of linear time-variant systems of arbitrary order is established using Hermite-Biehler framework. The resultant controller synthesis algorithm is programmable for linear systems of arbitrary order.**