Note on the Schur–Cohn–Jury criterion

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In his note on the Schur–Cohn–Jury criterion, Yeung (1982) has derived upper and/or lower bounds for \( P(1) \) and \( P(-1) \), respectively, where

\[
P(z) = a_n z^n + a_{n-1} z^{n-1} + \ldots + a_0, \quad a_n > 0
\]

is the characteristic polynomial of the system.

Such bounds were derived in Mansour (1963) without considering the specific value of \( a_0 \). Those bounds were obtained by considering a certain distribution of the roots, namely all roots are either at +1 or −1 in the limit. However, considering a specific value of \( a_0 \) all the roots except one have to be either at +1 or −1, and the remaining root is to be at \( \pm a_0/a_n \) in order to get a bound for \( P(1) \) and \( P(-1) \).

In this case the results of Yeung can be readily obtained, namely

\[
P(1) \leq (a_n + a_0)^{2^{n-1}} \quad P(-1) \leq (a_n + a_0)^{2^{n-1}} \quad \text{for } n \text{ even}
\]

\[
P(1) \leq (a_n + a_0)^{2^{n-1}} \quad P(-1) \geq (a_0 - a_n)^{2^{n-1}} \quad \text{for } n \text{ odd}
\]

In Mansour (1963, 1964, 1965 a, b, c) magnitude conditions, inverse magnitude conditions and coefficient conditions were obtained as necessary conditions for stability of discrete systems. In Unbehauen (1964) necessary conditions for stability were obtained using bilinear transformation. It is to be noted that the magnitude conditions, inverse magnitude conditions and coefficient conditions can be derived using the conditions of Unbehauen (1964). Extension of some of the results for the stability of two-dimensional systems can be found in Agathoklis and Mansour (1982).

REFERENCES

Mansour, M., 1963, Proc. 2nd IFAC Congress, Basle (Butterworth); 1964, Regelungstechnik, 12, 267; 1965 a, Automatica, 2, 167; 1965 b, Regelungstechnik, 13, 529; 1965 c, Ibid., 13, 448.
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