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ON THE CHARACTERISTIC POLYNOMIAL OF MATRICES WITH PRESCRIBED COLUMNS AND THE STABILIZATION AND OBSERVABILITY OF LINEAR SYSTEMS*

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Abstract. Let $A \in F^{n\times n}$, $B \in F^{n\times t}$, where F is an arbitrary field. In this paper, the possible characteristic polynomials of $[\,A \quad B\,]$, when some of its columns are prescribed and the other columns vary, are described. The characteristic polynomial of $[\,A \quad B\,]$ is defined as the largest determinantal divisor (or the product of the invariant factors) of $[\,xI_n - A \quad -B\,]$. This result generalizes a previous theorem by H. Wimmer which studies the same problem when $t = 0$. As a consequence, it is extended to arbitrary fields a result, already proved for infinite fields, that describes all the possible characteristic polynomials of a square matrix when an arbitrary submatrix is fixed and the other entries vary. Finally, applications to the stabilization and observability of linear systems by state feedback are studied.

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