**ELA**

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# SOME CHARACTERIZATIONS OF TOTALLY NONPOSITIVE (TOTALLY NEGATIVE) MATRICES[*]

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**Abstract.** An $n \times m$ real matrix $A$ is said to be totally nonpositive (totally negative) if every minor is nonpositive (negative). In this paper, we study characterizations of these classes of matrices by minors, by their full rank factorization and by their thin $QR$ factorization.

**Key words.** Totally nonpositive and totally negative matrices, Full rank factorization, Thin QR factorization.

**AMS subject classifications.** 65F40, 15A15, 15A23.