

Letters

Comments on “Unconditional Stability”

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I. INTRODUCTION

Some time ago, I gave three inequalities as a necessary and sufficient condition for unconditional stability [1] [2]. They are

$$|S_{12}S_{21}| < 1 - |S_{11}|^2$$

$$|S_{12}S_{21}| < 1 - |S_{22}|^2$$

$$|S_{11}|^2 + |S_{22}|^2 + 2|S_{12}S_{21}| < 1 + |S_{12}S_{21} - S_{11}S_{22}|^2$$

where the S_{ij} 's are the scattering parameters. Recently, Edwards and Sinsky [3] indicated that various authors including myself had claimed that the first two inequalities were both required. This is a misunderstanding. Let me explain why.

Let P and Q be two statements and suppose that if P , then Q . Q is said to be a necessary condition for P and, equivalently, P is said

Manuscript received November 10, 1992; revised January 10, 1993.

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IEEE Log Number 9210224.

to be a sufficient condition for Q . So “ Q is a necessary and sufficient condition for P ” means that if P , then Q and, simultaneously, if Q , then P . Whether P or Q contains some redundant description or not is irrelevant. Consequently, in spite of the adjective necessary, Q may contain some redundant description. In the above stability discussion, if P represents unconditional stability, Q is the three inequalities. Since Q may contain some redundant description, Q including the first two inequalities does not imply that they are both required.

The redundancy may not be the most desirable. So, Woods [4] described Q as mathematically correct but unnecessarily complicated.

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