

# 2<sup>nd</sup> International Conference and Exhibition on **Lasers, Optics & Photonics**

September 08-10, 2014 Hilton Philadelphia Airport, USA

## A new stability method for determining the stability boundaries of a multi-mode laser

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Up to now, the stability conditions of lasers have generally been investigated by a tedious and complicated method in which the stability coefficient determinant was first expanded in terms of one of the rows or columns to derive the characteristics equation. The Hurwitz's criteria are then used to find the simultaneous negative roots for the characteristics equation as the stability boundaries of lasers. The most important problem is that searching about the Hurwitz's criteria is a very difficult job and introduces many additional conditions irrelevant to the laser stability boundaries. Recently, we have solved this problem by zeroing the main diagonal arrays of the stability coefficient determinant one by one until the determinant is nullified. The roots of diagonal arrays are then turned up as the exact stability boundaries of a multi-mode laser. For example, this method has been used to delimit the stability, bistability, and instability regions of a three-mode class-A laser with three freedom degrees in our recent publication. In the present time, we have used this method to determine the stability boundaries of a three-mode class-B laser with five freedom degrees. The results are justified by the energy conservation and will be released in future soon.

### Biography

Jafar Jahanpanah received BSc in Applied Physics from Amir Kabir (Tehran Polytechnic) University, Tehran, Iran, in 1989, MSc in Optics Communication, and PhD in Laser Theory from Essex University, Colchester, UK, in 1992 and 1995, respectively. He is an Associate Professor of Physics and has been the Chairman of the Science Faculty at Kharazmi University since 2009. His current research interests include laser noise and also the gain, stability, and mode-locking phenomena in multi-mode lasers. He has publications in journals of *PRA*, *OSA*, *Applied Physics*, *Laser Physics*, *J. Phys. B*, and *Optics Communications*.

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