Parity-time Symmetry Concepts Applied to Guided Optics

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I will present an introduction and an overview on the concept of parity-time symmetry to guided wave optics. The concept of parity-time (PT) symmetry was introduced as a way to consider operators that have a real eigenvalue spectrum, but that are not Hermitian, which means that an imaginary potential is introduced. In optics, this turns out to be equivalent to have a dielectric constant whose real part ─ index-related─ is symmetric, and imaginary part ─gain/loss related─, is antisymmetric. It has become an important topic in optics since the first papers around 2008, with a few pioneer demonstrations emerging since 2010. To this end, we will present (1) a one-course introduction to waveguides in photonics and their use for switching and filtering, including a link to plasmonics; (2) a course on foundation of PT symmetry and its basic features: implementation for transverse geometry, symmetry breaking and new eigenmodes, exceptional point. A first application to switching will be considered; (3) a course on PT-symmetry of periodic structures and unidirectionality effects; (4) a course on specific advances related to PT symmetry and plasmonics, and PT symmetry in multiple waveguides and multimode waveguides. Some consideration for realistic applications will also be discussed.