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Nonlinear Kerr enhancement of the Sagnac effect in a coherently coupled array of optical microresonators CHAO WANG, CHRISTOPHER SEARCH, Department of Physics and Engineering Physics, Stevens Institute of Technology — Optical gyroscopes based on the Sagnac effect are of great interest both theoretically and practically. Previously it has been suggested a nonlinear Kerr medium inserted into a ring resonator gyroscope can largely increase the rotation sensitivity due to an instability caused by the non-reciprocal self-phase and cross-phase modulations. Recently, coupled microresonator arrays such as Side-Coupled Integrated Spaced Sequence of Resonators (SCISSOR) and Coupled Resonator Optical Waveguides (CROW) have drawn interest as potential integrated gyroscopes due to the sensitivity enhancement resulting from distributed interference between resonators. Here we analyze a SCISSOR system, which consists of an array of microresonators evanescently coupled to two parallel bus waveguides in the presence of a strong intra-resonator Kerr nonlinearity. We show that the distributed interference in the waveguides combined with the nonlinearly enhanced Sagnac effect in the resonators can further improve the sensitivity compared with either a single resonator of equal footprint or SCISSOR without a Kerr nonlinearity. Numerical simulation shows that bistability in the SCISSOR occurs and the rotation sensitivity $\frac{dI_{output}}{d\omega}$ can go to infinity near the boundaries of the bistable region.

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