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Ethan Koenig* (ethankoenig@gmail.com), Department of Mathematics, 310 Malott Hall, Cornell University, Ithaca, 14853, and **Jessica Walker** (jalise.walker@gmail.com), Mary Baldwin College, P.O. Box 1500, Staunton, VA 24402. *Bifurcation scenarios in external cavity and delay-coupled semiconductor lasers.*

We investigate various bifurcation scenarios in external cavity (single) and mutually delay-coupled semiconductor lasers. The behavior of these lasers is described by the Lang-Kobayashi complex delay differential equation system. This system contains a number of parameters; we considered two scenarios in our research. The first one was the occurrence of Hopf bifurcations when the feedback strength is changing; we identified the regions in the parameter space where certain special solutions (called external cavity mode solutions) lose stability and new types of solutions appear and persist for certain feedback strengths. We also described where these types of solutions disappear from the phase space. The second area of investigation concerned delay-coupled semiconductor lasers; we examined the geometric background underlying the saddle-node bifurcation structure behind compound laser mode (CLM) solutions. We identified the mechanism which drives the appearance of new CLM solutions as the coupling rate is changing for various detuning values. Regions of existence of different types of solutions were created on the coupling rate - detuning parameter plane. (Received September 04, 2014)