

The continuous adjoint provides gradients for an objective with respect to an arbitrary number of design variables, at a significantly lower computational cost than methods such as the finite difference. Traditionally the objective functions that it can address are limited, and multiple objective problems require separate adjoint evaluations. Over the course of my PhD research, I have developed methods to use the continuous adjoint for a wider range of objectives, including combinations of objectives and objectives that rely on multi-fidelity simulation. Supersonic combustion ramjets, or scramjets, are airbreathing hypersonic engines that have the potential to facilitate more efficient trans-atmospheric flight and airplane-like operations of launch vehicles. Many challenges exist in their design, and component efficiency must be balanced against various constraints and overall system performance. The complex physical phenomena encountered motivate the inclusion of high fidelity simulation early in the design process. I have applied continuous adjoint methods to a scramjet inlet shape design, with consideration of combustor and nozzle performance as well as heat flux into the inlet surface.