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Automating Aerospace Synthesis Code Generation: A Tool for Generic Vehicle Design and Technology Forecasting

By

Thomas McCall

Thesis Advisor: Dr. Bernd Chudoba

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Teams link

Abstract

The principal development and deliverable of this research is a generic synthesis assembling decision support environment for early conceptual design that automates the assembly of synthesis architectures for enhanced product exploration and technology forecasting. The objective of this research is to develop a baseline environment to assess complex vehicle automated synthesis architecture synthetization procedures for adaptation into a greater cognitive system. This tool has been developed as a precursory and developmental task in an initiative towards an artificial intelligence design and research assistant peer. The artificial intelligence peer is a perceived course for future design system evolution in the continued atomization of design tools in an attempt to improve designs, design time to solution, and to create a more effective designer.

The tool developed creates tailored synthesis codes based on user-designated requirements, removing the tedious task of architecture assembly by the user and avoiding the monolithic program approach. It does so through an automated composable architecture formulation routine. It is configuration, process, and method independent. The composition scheme utilizes a component warehousing approach for assembly sourcing and reuse. The system has been developed in Python; functionality and applicability are demonstrated through a verification case and an exploratory trade study case. The verification case utilizes the hypersonic GHV and the X-51A to demonstrate automated system assembly and method correctness. The trade study case evaluates air-launched airbreathing and non-airbreathing concepts for consideration as reusable hypersonic vehicle research and development platforms. The GHV and X-51A, in addition to the Model-176, serve as baseline concepts for the trade vehicles. A solution space for hypersonic test vehicles is assembled, visualized, and discussed. The concept solutions are considered in light of carrier vehicle geometric and weight constraints. Successful execution of the case studies demonstrated proper system functionality.