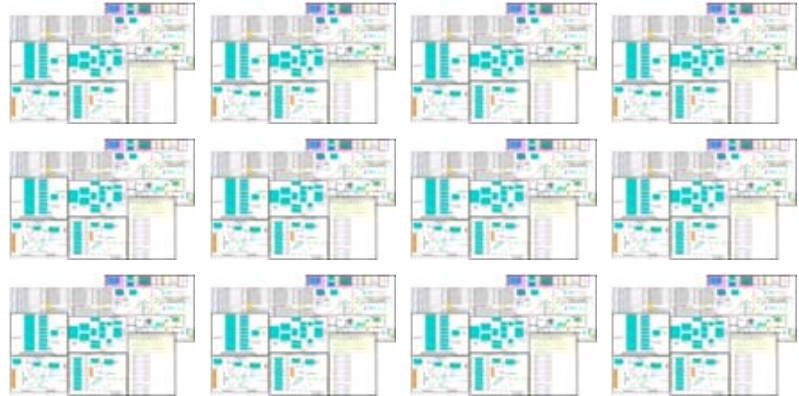


## Accelerating Innovation: Avetec at a Glance

### Avetec Advances Parallel Simulation Execution on High Performance Computing Platforms

Simulation models can be used to explore the design space for complex systems using techniques including parameter studies, design optimization, computational uncertainty analysis, and design of simulation experiments. There are commercial software frameworks for conducting these types of analyses in a unified framework. These coordinate model execution in a serial fashion. However, serial execution of complex system models can lead to long simulation runs and may be difficult to do for large scale studies.



Within the research community, several groups are exploring the use of parallel execution frameworks for conducting large scale design studies using high performance computing platforms. By combining parallel model execution techniques with agile, rapid prototyping of models in a graphical environment, we can quickly understand complex system interactions and behavior.

Researchers at Avetec have developed techniques for conducting large scale simulation experiments on high performance computing platforms. These use a model executive that can run either in serial or parallel mode on platforms ranging from a single PC to a large cluster with thousands of nodes. Model development tools such as MATLAB<sup>®</sup>, Simulink<sup>®</sup>, AMERun<sup>1</sup>, Python, or traditional programming languages can be used to supply the underlying simulation model. The environment then schedules simulation jobs and accumulates results of each simulation in a database for further analysis after the simulation run.

In a parameter study, model output values are calculated and tabulated at each point in the parameter space. Complex system models may have tens or hundreds of parameters and output variables. In optimization problems input parameters are adjusted in order to minimize or maximize one or more performance objectives. In an uncertainty analysis, the user wishes to understand how uncertainty in input parameters relates to uncertainty in the output parameters. For large problems it may be necessary to execute millions of simulation runs in order to achieve the required results. By executing these simulations in a high performance computing cluster we take advantage of computing resources and minimize total run time. These types of studies and others are supported in the Avetec environment.

In a recent benchmark test, Avetec researchers conducted a propulsion system design simulation study using a Simulink<sup>®</sup> model with a 15 dimension input parameter space and a 10 dimension output space. A parameter study spanning the input parameter space completed over 1.4 million simulation executions in under 30 minutes using 90 cores on Avetec's in-house cluster. Avetec is currently offering simulation study research services to customers.

For more information contact Dr. Jeff Dalton at (937) 322-5000 x2007 or at [jdalton@avetec.org](mailto:jdalton@avetec.org).

<sup>1</sup> AMERun is a product of LMS International.