http://www.isuzutechcenter.com/

Full Vehicle Cooling System Model Development

Isuzu is continuously moving more and more towards virtual calibration and model based development. As part of this process, having a predictive cooling system model of a vehicle is fundamental. A predictive model of the cooling system will not only enable us to understand how it behaves under real operating conditions, but improve the boundary conditions we use to model other aspects of the powertrain and vehicle.

The student team will develop and complete 1D and 3D vehicle cooling system models for Isuzu’s Model Based Engine Development. Once validated the model will be used for analytic sizing of coolant pumps and radiators, predicting heat rejection for the engine cylinder and thermal analysis of full vehicle cooling system.

The predictive cooling system model will be an indispensable component of Isuzu full vehicle model based system. The full vehicle system will be used for Isuzu engine virtual calibration and full vehicle model based development.

Description of Project

**BASELINE GOAL**

1D, thermal steady-state, GT underhood cooling system model sufficiently accurate to be used for pump sizing, radiator sizing and investigation of cooling system design. This model should be capable of basic thermal prediction for the vehicle cooling system.

**Intermediate Goal**

Transient Detailed Engine Thermal Coolant System. Develop fully thermal, detailed 1D GT model for the engine to provide Transient Engine Heat Rejection Prediction for certain duty cycles.

**HIGH SUCCESS**

1) Transform the 1D steady state GT full vehicle cooling simulation into transient thermal simulation.
2) Investigate possible solutions for other components as well: such as TaiTherm for cabin cooling, detailed model for CAC cooling, radiator etc.

Location
Most work will be completed on campus. There will be periodic visits to Isuzu’s office in Plymouth, Mi for consultation with our engineering team.

Project Sponsor Mentor

**Yong Sun, Model Based Development Engineer II**
I focus on CFD simulation. I am a Master’s graduate (2012) in Aerospace Engineering from the University of Michigan-Ann Arbor. Previously, I worked at Oak Ridge National Lab and Ricardo, Inc.

**Rohil Daya, Model Based Development Engineer**
I focus on 1-D Diesel After treatment Modeling. I am a Master's graduate (2015) in Mechanical Engineering from the University of Michigan-Ann Arbor. My graduate research and coursework concentration was in thermal and fluid sciences, with an application in automotive engineering. My career and research interests include vehicle and engine thermal management, after-treatment systems and emissions control, and combustion processes in internal combustion engines. I am a proponent of clean transportation and power for a cleaner environment!

Project Faculty Mentor

**Kazu Saitou**

**Professor, Mechanical Engineering**
Key Skills & Project Roles

MDP Sponsored Projects are both a professional and academic learning experience for students. By participating in this program, students are actively preparing for graduate school and a professional career. As part of the experience, MDP expects professional behavior. To best prepare you for future professional opportunities, your experiences on this MDP team will be very broad. In addition to key technical skills that you will bring to the team, you will engage deeply in the self-directed learning of new and important concepts, demonstrate flexibility, collaboration, and cooperation, and develop strong professional communication skills. This also means that you will need to be able to work outside of your traditional area of study in the true multidisciplinary nature of our projects. You won’t always be able to anticipate how your skills and expertise will be used, so the MDP Sponsored Project will challenge you to grow and develop as a professional.

<table>
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<tr>
<th>Project Roles</th>
<th>Key Skills and/or Knowledge</th>
<th>Likely Majors</th>
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<tr>
<td>Advanced Heat Transfer / Fluid Dynamics Modeling (3 students)</td>
<td>Develop 1D, 2D and 3D models incorporating both heat transfer and fluid dynamics. Some experience with computational fluid dynamics (CFD).</td>
<td>ME, MICDE, ISD-Auto, ChE, AERO, Physics</td>
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<td>Internal Combustion Engines (2 students)</td>
<td>Bring a detailed understanding of internal combustion engines to support the team model development. ME 438 combustion engines (or equivalent).</td>
<td>ME, ISD-AUTO, ISD-GAME</td>
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<tr>
<td>Model &amp; Simulation Development (2 students)</td>
<td>Build and validate 1d, 2d and 3d models of cooling system</td>
<td>Stats, MATH, MICDE</td>
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<tr>
<td>AUTO 503, GAME 503, ME 490, Honors, ME 590, MICDE</td>
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Desired Additional Knowledge, Skills and Experience:
Experience with GT-Suite modeling software. Practical experience with combustion engines. Experience developing and validating advanced models to real world data.

Company Overview

Isuzu is the global leader in commercial vehicles and diesel engines. We consistently focus on “creation without compromise” in the process of building and maintaining a world class organization. By expanding our operations across the globe, Isuzu products benefit people in over 100 countries. To ensure the most advanced performance and superb service, we are moving forward in product development, quality, manufacturing systems and customer support, which will become the new global standards of excellence. We hold an uncompromising commitment to improvement for better products and a better partnership with the world.

Legal Requirements

Citizenship and Right to Work Options (please select)
This project is open to all students regardless of citizenship.

Intellectual Property Agreements / Non-Disclosure Agreements (please select)
Students will sign the standard MDP IP/NDA agreement

Internship Information

Summer Internship Interview Guarantee