

Simulation of Artificial Intelligence Agents using Modelica and the DLR Visualization Library

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This paper introduces a scheme for testing artificial intelligence algorithms of autonomous systems using Modelica and the DLR Visualization Library [1]. The simulation concept follows the 'Software-in-the-loop' principle. No adaptations are made to the tested algorithms. The environment is replaced by an artificial world generated by the Visualization Library and the rest of the autonomous system is modeled in Modelica. The scheme is introduced and explained by using the example of the ROboMObil [2], which is a robotic electric vehicle developed by the DLR's Robotics and Mechatronics Center.

The variety of autonomous systems, or also known as artificial intelligence agents (AIA), can range from small toys like Lego mindstorms to full-sized robotic cars like the ROboMObil (ROMO). In all cases an agent consists of three essential parts: sensors, the core artificial intelligence for the agent's functionality, and actuators. The agent perceives its current environment through its sensors, interprets it and plans the next actions to reach its goal before acting upon the environment through its actuators. For a sufficient simulation of an autonomous system the bidirectional connection of an agent to its environment must be considered.

The combination of Modelica with the DLR Visualization Library creates a powerful tool for an efficient development of complex physical agent and environment models.

Our motivation for the presented scheme is a bidirectional autonomous systems simulation, which combines extensive Modelica models of the ROMO with the artificial intelligence system used in the real vehicle.

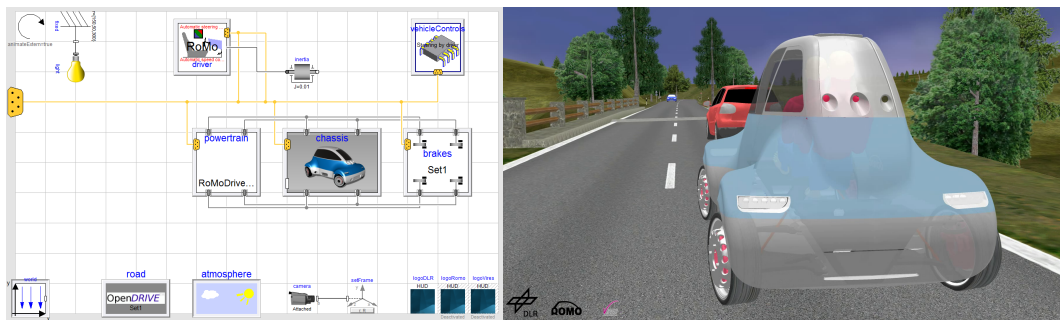


Figure 1: A Modelica model of the ROMO using the DLR Visualization Library and the corresponding visualization

References

- [1] Tobias Bellmann. Interactive simulations and advanced visualization with modelica. In *Proceedings 7th Modelica Conference, Como, Italy, 2009*.
- [2] Jonathan Brembeck, Lok Man Ho, Alexander Schaub, Clemens Satzger, and Gerhard Hirzinger. Romo - the robotic electric vehicle. In *22nd International Symposium on Dynamics of Vehicle on Roads and Tracks*. IAVSD, 2011.