Simulation is more than Software ®

ANSYS EMBEDDED SOFTWARE Update in 2020 R1

Embedded software is increasingly being used in smart devices, but imperfect code can be the cause of many product failures. Industry leaders estimate that every 1,000 lines of embedded software contain eight bugs. To manage this quality risk and meet higher standards for software certification, you need to leverage embedded software development and verification tools, as well as certified code generators.

ANSYS provides a model-based embedded software development and simulation environment with a built-in automatic code generator to accelerate embedded software development projects. System and software engineers use ANSYS SCADE solutions to graphically design, verify and automatically generate critical embedded systems and software applications with high dependability requirements. SCADE solutions are highly interoperable and can be easily integrated, optimizing development and increasing communication among team members.

Certified code generation across industries

SCADE code generators and verification tools have been qualified/certified at the highest level of safety across six market segments by more than 10 safety authorities worldwide, including:

- DO-178C up to Level A for aerospace and defense applications by FAA, EASA, Transport Canada, CAAC and ANAC
- ISO 26262 up to ASIL D for automotive applications by TÜV SÜD
- IEC 61508 up to SIL 3 for transportation and industrial applications by TÜV SÜD
- EN 50128 up to SIL 3/4 for rail transportation applications by TÜV SÜD, EBA and Certifer
- IEC 60880 demonstrated compliance for nuclear applications by many nuclear safety authorities

SCADE speeds the embedded software development and verification process

SCADE users report the following development and verification cost improvements:

- Alignment of the design process according to safety standard objectives
- Reduction of development costs by 50%, on average
- Acceleration of time to certification by a factor of two

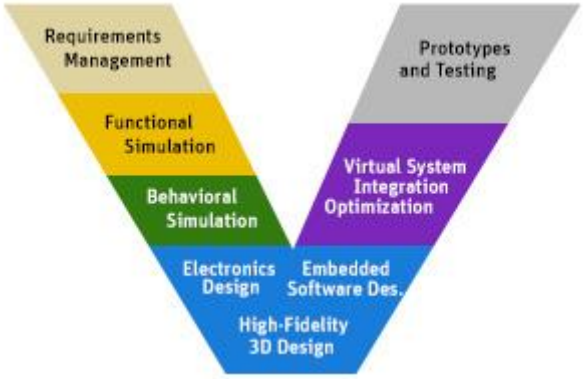
Applications:

MODEL-BASED SYSTEMS ENGINEERING:

Model-based systems engineering (MBSE) is key to using systems models to define requirements, design, analysis, and verification and validation activities throughout the development cycle. It keeps track of these interdependencies with an evolving model instead of written design specifications, so you can be sure that all subsystems mesh together in a finely tuned whole, even as you continue to change the design.

To better manage the complexities of today's product architectures and truly understand and manage the countless dependencies across sub-systems, traditional systems engineering practices have evolved to model-based systems engineering (MBSE). The fundamental difference is that the authoritative system definition no longer resides in a set of static text-based design documents, but rather in a living model. This model provides a thorough understanding of the dependencies and interfaces between the various subsystems. In addition

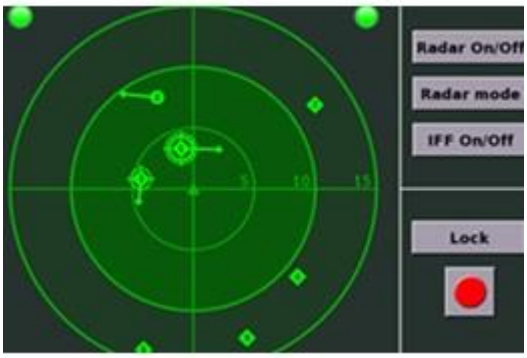
to representing large amounts of information in more sophisticated, interrelated ways, models are easily shared and communicated across teams, more amenable to change management, and support automated and comprehensive traceability from stakeholder requirements to implementation.



Examples:

Representation of Systems Operational Scenarios

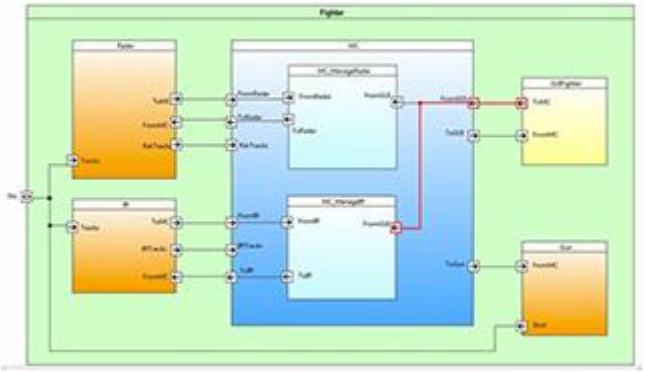
Mission Computer Demo



SCADE Systems for Avionics Package

EMBEDDED CONTROL SOFTWARE DEVELOPMENT

More and more, in applications from commercial aircraft to autonomous vehicles, the quality of the embedded software development process determines operational efficiency and safety. Certified code generators like the one in ANSYS SCADE ensure that your embedded software will work as planned, the first time and every time.

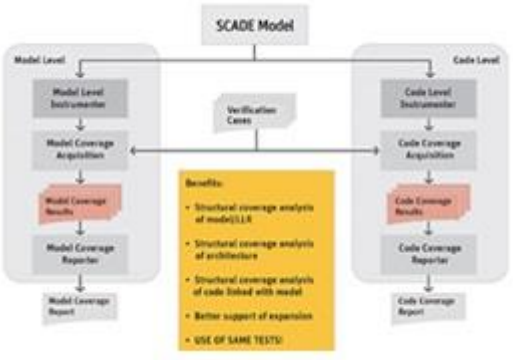


Embedded software is essential to the operation of today's smart devices; poorly designed software is increasingly becoming the source of product failures. To manage this quality risk, as well as to meet tighter standards for software certification, embedded software engineers need to leverage software simulation tools and certified code generators.

ANSYS SCADE solutions provide a model-based embedded software development and simulation environment with a built-in automatic code generator. The embedded software model is exactly implemented by the generated code without any ambiguity. With ANSYS SCADE solutions, you can be sure that the behavior observed in the simulation will match the behavior in the target embedded software platform.

Examples:

DO-178C Certification for Embedded Software



Communication Based Train Control Solutions

SCADE usage for wind Turbines

SCADE Usage for unmanned Aircraft Vehicles

SCADE Usage for Aircraft Brakes Systems

SCADE Usage for Railway Interlocking Applications

SCADE for Industrial Machine Control

MAN-MACHINE Interface Software

Despite all their autonomy, today's smart products still must interact with a human being occasionally through an intuitive, easy-to-use man-machine interface. You can optimize the usability and reliability of your interface using software development and certified code generation tools from ANSYS.

Man-machine Interface software is used widely across all industries, from cockpit display on aircraft, to control room displays in nuclear facilities to infotainment systems in the automobile that you are driving. To meet tighter standards for software certification, embedded software engineers will need to leverage software simulation tools and certified code generators.

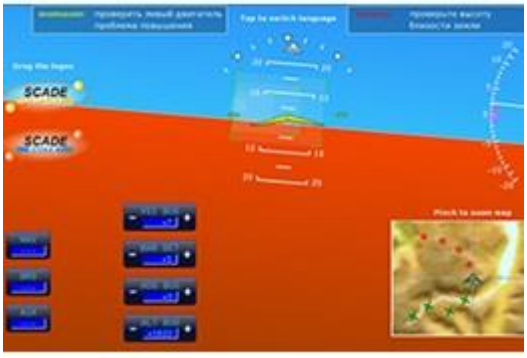
ANSYS provides model-based man-machine interface development software with a built-in automatic code generator. This software can be used to create the graphics for the display as well as the control logic driving the display.

Examples:

SCADE Usage for Civilian & Military Aircraft Displays

SCADE for UAV Ground Stations

Intelligent Glass Cockpit Displays



Interactive ERTMS Driver Machine Interface Demo

VIRTUAL SYSTEMS PROTOTYPING

While physical prototypes are still valuable for late-stage testing of a new product, digital prototypes are the only way to go when you are exploring the numerous design possibilities early in the process. Digital systems prototyping saves you time and money, guiding you to an optimal product design in a fraction of the time of the obsolete build-and -test method.

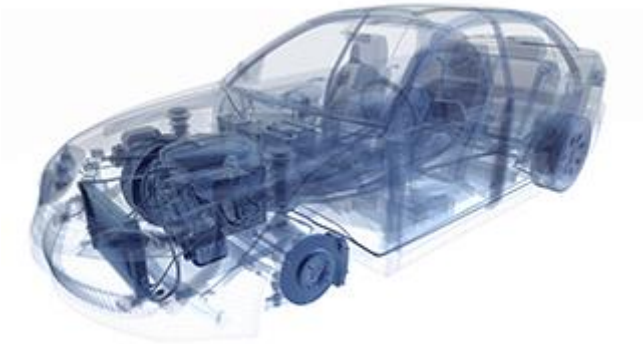
Today's product development process is complex. With virtual systems prototyping, developers can assemble and simulate electrical, electronic, thermo-fluid, mechanical and embedded software components. The methodology offers 3-D precision when needed as well as reduced-order modeling for verifying multidomain system performance interaction.

Examples:

VSP at GM for Battery Pack Design

FUNCTIONAL SAFETY ANALYSIS

The analysis and verification of functional safety for electronic control systems in industries like automotive, aerospace and defense, rail, nuclear, etc., are critical to system design and implementation.



ANSYS medini analyze performs functional safety analysis in applications for automotive, aerospace and defense, rail, nuclear and other safety-critical industries. It is fully integrated with ANSYS products for system modeling, simulation and embedded software development via ANSYS SCADE Architect, the ANSYS system and software architecture modeling tool.

The solution automates the analysis and verification of functional safety for electronic control systems. It helps to implement step-by-step modeling, analysis and verification processes that conform to applicable safety standards. The result is a system architecture that accounts for the safe, reliable interactions of dozens of components. ANSYS medini analyze also automates the analysis of failure modes and ensures that safety mechanisms are in place to protect against them over a wide range of operating scenarios.

ANSYS SCADE Suite sets the standard in the global aerospace and automotive industries for system architecture modeling and automated generation of embedded software code. SCADE's proven, step-by-step method for modeling a robust control system architecture ensures that all critical components that govern braking, steering and other functions work together seamlessly and reliably. Software engineers can work quickly and efficiently to generate mission-critical code, with the assurance that they will meet both regulatory standards and project deadlines.

With these two specialized modeling tools, engineers across industries have, for the first time, a seamlessly integrated toolkit. Combining the step-by-step processes of SCADE and medini analyze will ensure the creation of system architectures that meet all relevant industry standards for safety and control — quickly and cost-effectively.

Examples:

Analysis & Development of Safety-Critical Embedded Systems: The Need for an Integrated Toolkit- White Paper