

## **Definition and Design of software components for LEON3FT Microcontroller and LEON-REX**

LEON-REX defines a new instruction set which extends the standard SPARC V8 instruction set with 16-bit variants of the most common instructions. These shorter instructions can be used to decrease the code size and increase the instruction cache hit ratio. LEON-REX has been implemented for both LEON3 and LEON4 by Cobham Gaisler, and will be available in the ESA funded GR716, a LEON3FT rad-hard microcontroller for space applications.

The objective of this activity has been to provide the definition and design of a complete LEON-REX capable toolchain. The toolchain consists of compiler, assembler, linker and standard c library with LEON-REX support, and is the basic requirement for software development using the new instruction set. The main focus has been on the design of a LEON-REX LLVM compiler backend, but the activity has also generated an updated assembly language reference, additions to the SPARC ABI to support LEON-REX, new linker relocations, and a test plan for the toolchain.

In conjunction with this activity a fully working LLVM backend has been implemented for LEON-REX, following the activity's design output. Efforts are currently being made to make the new backend part of the official LLVM release. The compiler will be included in BCC, Cobham Gaisler's bare-metal compiler distribution, together with the additional support required to make it possible to compile and run software on the GR716 microcontroller using the LEON-REX instruction set.