

## R0 - ARM fundamentals

This course covers ARM architecture V4T and V5TE fundamentals

### Objectives

- ARM modes state machine is detailed, clarifying the register banking mechanism.
- Subtleties of ARM instruction set are covered, such as conditional execution, addressing modes, operand shifting.
- Interworking between ARM and Thumb instruction sets is explained.
- The exception mechanism is studied, particularly interrupt nesting.
- The course also covers ARM926EJ-S cache and MMU operation.

*Labs are run under RVDS*

*A more detailed course description is available on request at [formation@ac6-formation.com](mailto:formation@ac6-formation.com)*

### Prerequisites

- Basic knowledge of CPU or DSP.
- This one-day course has been designed to meet the pre-requisites of ARM11 and Cortex-A/R courses.  
This is a summary of ARM7/9 course.

### Course Environment

- Theoretical course
  - PDF course material (in English) supplemented by a printed version for face-to-face courses.
  - Online courses are dispensed using the Teams video-conferencing system.
  - The trainer answers trainees' questions during the training and provide technical and pedagogical assistance.
- At the start of each session the trainer will interact with the trainees to ensure the course fits their expectations and correct if needed

### Target Audience

- Any embedded systems engineer or technician with the above prerequisites.

### Evaluation modalities

- The prerequisites indicated above are assessed before the training by the technical supervision of the trainee in his company, or by the trainee himself in the exceptional case of an individual trainee.
- Trainee progress is assessed by quizzes offered at the end of various sections to verify that the trainees have assimilated the points presented
- At the end of the training, each trainee receives a certificate attesting that they have successfully completed the course.
  - In the event of a problem, discovered during the course, due to a lack of prerequisites by the trainee a different or additional training is offered to them, generally to reinforce their prerequisites, in agreement with their company manager if applicable.

## Plan

### THE ARM V4T / V5TE ARCHITECTURE

- ARM operation modes
- The ARM registers set, register organization summary according to the current mode
- Program Status Registers
- Exception handling, vector table, automatic switch into ARM mode

### ARM AND THUMB INSTRUCTION SETS

- Conditional execution and flags
- Branch instructions
- The barrel shifter
- Immediate constants
- Single register data transfer
- Stack management
- Register access in Thumb
- ARM architecture V5TE new instructions

### ARM / THUMB INTERWORKING

- Switching between states
- Mixing ARM and Thumb subroutines
- ARM to thumb veneer
- Thumb-to-ARM veneer
- Interworking calls

### EXCEPTION HANDLING

- Exception priority
- Vector table instructions
- Chaining exception handlers
- FIQ vs IRQ
- Example C interrupt handler
- Issues when reenabling interrupts
- C nested interrupt example
- Data abort with memory management
- Adjusting the return address

### MEMORY MANAGEMENT & PROTECTION

- Introduction to page management
- Translation Lookaside Buffer
- Benefits of Fast Context Switch Extension
- ARM926 MMU
- Organization of page descriptor tables
- Configuration & control through CP15

### MEMORY SUBSYSTEMS

- Cache basics
- Hit under miss and its consequence: out of order abort
- Highlighting data flows between main memory and caches
- Write buffer
- Tightly coupled memories

## Renseignements pratiques

**Duration :** 1 day

**Cost :** 700 € HT