

# CSE – Scientific Computing

## Computational Science and Engineering with a focus on Scientific Computing

### 2. Short scientific description

**Vision:** *Innovation based on advanced computational science and engineering*

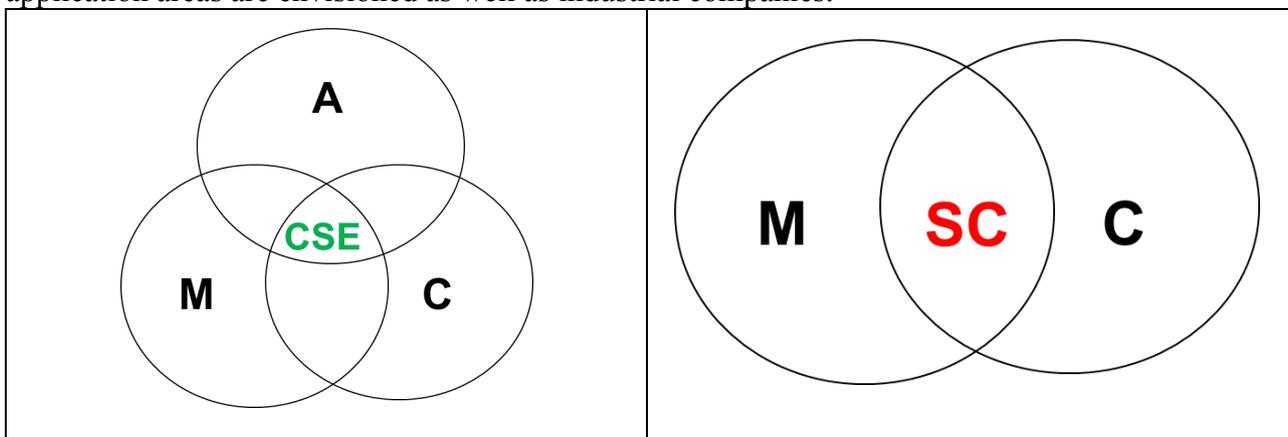
**Key idea:** We propose to develop *new mathematical, computational and visualization methods, and scientific software* adapted to take full advantage of emerging hardware technologies to enable unprecedented computational tools for addressing challenging problems arising in engineering and natural sciences.

Computational science and engineering (CSE) represents a means of scientific discovery that employs a computer system to study physical or man-made systems, as described by mathematical models that incorporate the laws derived from theory and experiments. The development of this field has drawn from a deep pool of scientific, mathematical, computational, and engineering knowledge and methodologies. Six decades after the invention of the digital computer, computational science has attained peer status with theory and experiments in many areas.

The research approach in the CSE-Centre initiative at NTNU/SINTEF is to form interdisciplinary teams that combine application knowledge with expertise and advanced methodologies from mathematics and computer science; this is the so-called MAC-model illustrated in Figure 1.

Scientific Computing (SC) is herein understood as the intersection between mathematics and computer science related to development and implementation of computational methods on computers. Scientific computing includes (but not limited to) research themes as: mathematical analysis, numerical modelling, statistical methods, computer algorithms, parallel and heterogeneous computing, scientific visualization, computer architecture and design, and software engineering.

This lighthouse ("fyrtårn") is connected to the CSE-Centre initiative, and aim to strengthen the role and position for the IME faculty at NTNU by focusing on the enabling technologies, herein denoted Scientific Computing, relevant for CSE. However, collaboration with researchers within selected application areas are envisioned as well as industrial companies.



**Figure 1.** CSE (left) can be defined as the development and use of computer simulations to solve scientific and engineering problems. The MAC-model (left) seeks to balance the focus for R&D in Mathematics and Computer science with needs in identified/specific Applications. Scientific Computing (right) is considered as the intersection of Mathematics and Computer science related to theory, development and implementation of computational methods on computers.