Title: Computing in Science Education. Integrating a Computational Perspective in the Basic Science Education

In the last decades we have witnessed an incredible development of both computer hardware and software. Scientific problems that were previously solved on large special-purpose machines with special-purpose software can now be easily handled in general-purpose, interactive environments on standard PCs with the bonus of immediate visualization of the results. Surprisingly, the use of computers to solve mathematical problems still has little impact on university education around the world, particularly at the undergraduate level.
Given today's dominance of numerical simulations in research and industry, we think it is paramount to integrate numerical tools at all levels in the educational system.

A fundamental challenge to our undergraduate programs is how to incorporate and exploit efficiently these advances within the standard curriculum in mathematics and the natural sciences, without detracting the attention from many of the classical topics. This brings with it the major organizational challenge of how to get university teachers in a variety of different fields and departments to work together towards such a reform. Furthermore, if students are trained to use such tools from the earliest stages in their education, do such tools really enhance and improve the learning environment? In addition,and perhaps even more importantly, does it lead to better understanding and insight?

Although we don't have answers to all these topics, I will in this talk present one possible approach: Computational topics are gradually introduced in the undergraduate curriculum in several bachelor of science programs (undergraduate studies) at the University of Oslo (where I spend the fall semester), as an integral supplement to the classical scientific syllabus. Computations are introduced from the very first semester of study and linked up with the mathematics courses in the first and subsequent semesters. Furthermore, computational problems are integrated in basically all compulsory undergraduate physics courses, allowing university teachers to strengthen research-based teaching at a very early level of study.
A particular achievement of the Computing in Science Education project in Oslo is that we have managed to implement the computer-based methods by modifying existing science courses. I will present several examples from this project, with examples from courses across undergraduate programs as well as possible links to similar ongoing activities at MSU and potential applications.