

## Pre Authorized Autonomous study plan

<b>Title</b>	<b>Computational Structural Mechanics</b>
<b>Main contact</b>	(DICA, PoliMi): Prof. Alberto Corigliano
<b>Other contact</b>	(DICA, PoliMi): Prof. Alberto Taliercio
<b>Natinal and international scientific collaborations</b>	<ul style="list-style-type: none"> <li>• (DSTA, PoliMi): Prof. Aldo Frezzotti</li> <li>• (DMAT, PoliMi); Dr. Silvia Lorenzani</li> <li>• (DCMIC, PoliMi): Prof. Roberto Frassine, Dr. Luca Magagnin, Prof. Marinella Levi</li> <li>• (DEIB, PoliMi): Prof. Antonio Longoni, Dr. Giacomo Langfelder</li> <li>• (DMEC, PoliMi): Prof. Alfredo Cigada</li> <li>• (Dip. Ing. Civile, Ambientale e Meccanica, UniTn): Prof. Davide Bigoni, Prof. Nicola Pugno.</li> <li>• (Laboratoire de Mecanique et Technologie (LMT), ENS Cachan, Francia): Prof. Pierre Ladeveze, Prof. Olivier Allix</li> <li>• (LaMCos, INSA Lyon, Francia): Prof. Alain Combescure.</li> <li>• (Karlsruhe Institute of Technology, Germania) Prof. Jan Korvink</li> <li>• (Dept. of Mechanical Engineering, Northwestern University, Evanston IL, USA): Prof. Horacio D. Espinosa</li> <li>• (Dept. Mechanical Engineering, MIT, USA), prof. Sang-Gook Kim</li> <li>• (Dept. Mechanical and Aerospace Engineering, Univ. California Davis, USA), prof. David Horsley</li> <li>• and many other collaborations of DICA faculty members on Computational Structural Mechanics subjects.</li> </ul>
<b>Description and objectives</b>	<p>The offered study plan is related to scientific computation with particular reference to Computational Structural Mechanics. This discipline refers to Structural Engineering, Civil in particular, where numerical spatial discretization methods like the Finite Element Method have been initiated and developed in the 50s and 60s of the last century.</p> <p>Starting from the strong theoretical basis acquired by the Mathematical Engineer during the undergraduate course, during the Master of Science, inside the Computational Sciences study plan, various subjects are proposed for a more in-deep knowledge of theory and practice of computational structural mechanics and for the assessment of structural integrity.</p> <p>After an additional year of study, the proposed study plan allows the student to obtain the Master of Science in Civil-Structural Engineering in addition to the Master of Science in Mathematical Engineering.</p>
<b>Study plan</b>	<p>The Study Plan is built on the PSPA (Major) “Computational Sciences” with the addition of courses related to: the behaviour and mathematical modelling of structures (<i>Theory of Structures</i>), the Finite Element Method applied to structural analysis (<i>Computational Mechanics</i>), the study of the dynamical behaviour of structures (<i>Elements of dynamic of Structuraes</i>), the assessment of structural integrity in the presence of instable responses (<i>Stability of Structures</i>) and of elasto-plastic material behaviour (<i>Inelastic Structural analysis</i>).</p> <p>As a consequence, the proposed study plan contains the following courses, in addition to the mandatory ones in the Major “Computational Sciences”:</p> <ol style="list-style-type: none"> <li>1) 092845 – <i>Elements of dynamics of structures</i> (6 CFU, mandatory): from M.Sc in Civil Eng.</li> <li>2) 092839 – <i>Computational mechanics and inelastic structural analysis</i> (10 CFU, mandatory): from M.Sc in Civil Eng.</li> <li>3) 092843 – <i>Theory of structures and stability of structures</i> (10 CFU, mandatory): from M.Sc in Civil Eng.</li> </ol>
<b>Thesis</b>	<ul style="list-style-type: none"> <li>• M. Cremonesi (Ing. Mtm.), <i>Implementazione di tecniche di parallelizzazione e di un metodo lagrangiano a particelle di fluido finalizzati allo sviluppo di un codice di calcolo ad elementi finiti per problemi di interazione fluido-struttura</i>, 2006</li> <li>• E. Greco (Ing. Mtm.), <i>Metodi per la valutazione della dissipazione viscosa nei MEMS</i>, 2007</li> <li>• D. Arosio (Ing. Mtm.), <i>Modellazione e simulazione di fenomeni di adesione in microsistemi</i>, 2010</li> </ul>

	<ul style="list-style-type: none"> <li>• F. Rizzini (Ing. Mtm.), <i>Modelli semplificati e ad elementi finiti per la simulazione di fenomeni di adesione in microsistemi</i>, 2012</li> <li>• A. Bugada, M. Martello. (Ing. Mtm.), <i>Modellazione e simulazione di fenomeni dissipativi in microsistemi</i>, 2012</li> <li>• V. Zega (Ing. Mtm.), <i>Risonatore torsionale per microsistemi: modellazione, sperimentazione, applicazioni</i>, 2013</li> <li>• P. Fedeli (Ing Mtm) <i>Fenomeni dissipativi in microsistemi elettro meccanici</i> ... e molte altre tesi svolte da studenti di Ing. Civile, dei Materiali ed altri CS.</li> </ul>
Tesi in corso di svolgimento	Gabriele Rovi (Ing. Mtm), <i>Multi-physics simulations</i>
Tesi disponibili	<ul style="list-style-type: none"> <li>• <i>Multi-scale and domain decomposition methods applied to the simulation of fracture processes in polycrystalline and/or micro structured materials.</i></li> <li>• <i>Model Order Reduction techniques applied to the simulation of non-linear microsystem response.</i></li> <li>• Modelling and simulation of surface interaction and dissipative phenomena in microsystems.</li> <li>• Modelling and simulation of multi-physics phenomena. <i>Modelling and simulation of fluid-structure interactions</i></li> <li>• ... and many other thesis subjects related to Computational Structural Mechanics, proposed by DICA faculty members.</li> </ul>
Stages	Stages at STMicroelectronics. Other possible stages in companies with stable connections with DICA faculty members working in Computational Structural Mechanics.
Jobs opportunities	All job opportunities of the M.Sc. in Mathematical Engineering. Additional possibilities as stress analyst in Structural design groups and companies.
Second M.Sc in Civil Engineering	To obtain the second M.Sc. in Civil Engineering, the student that obtained the M.Sc in Mathematical Engineering following the study plan in Computational Structural Mechanics and making a M.Sc thesis in Structural Mechanics, must obtain 58 additional CFU during a six year. At the final exam for the M.Sc. in Civil Engineering, the student will discuss again the thesis prepared for the M.Sc. in Mathematical Engineering. The six year contains 58 CFU from courses and 14 CFU for the final exam, as shown in the attached table.

Table for a second M.Sc. in Civil Engineering.

CS	SEM	SSD	COD	INSEGNAMENTO	CFU
LP	1	ICAR/02	088500	Costruzioni idrauliche	10
LP	1	ICAR/07	088499	Geotecnica	10
LP	1-2	ICAR/09	088498	Tecnica delle costruzioni	12
LP	2	ICAR/04	088501	Elementi di tecnica stradale	10
LP	2 2	GEO/05 ING-IND/22	094742 095731	1 Course to be chosen: Rilevamento geologico tecnico Materiali da costruzione	6
LM	1 1 1-2 2 2	ICAR/07 ICAR/09 ICAR/09 ICAR/09 ICAR/09	094792 094795 094793 094799 095877	1 Course to be chosen: Foundations Bridges Buildings in Seismic areas Reinforced and pre-stressed concrete structures Steel Structures	10
LM	1-2		090864	Final exam	14
<b>Total CFU 6° year</b>					<b>72</b>