



Programme of Module "Modelling and control of networked distributed systems"

- Code: DT0011
- Type of course unit: Compulsory (Master Degree in Mathematical Engineering curriculum Comune)
- Level of course unit: Postgraduate Degrees
- Semester: 1

Number of ects credits: (Master Degree in Mathematical Engineering) 6 (workload 150 hours)

Teachers: Giordano Pola

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| 1 | <b>Course objectives</b>   | The aim of this course is to provide basic knowledge of the analysis and design of dynamic multiagent networks.   |
| 2 | <b>Course content and learning outcomes (dublin descriptors)</b> | <p>Topics of the module include:</p> <ul style="list-style-type: none"> <li>• Introduction to graph theory: graphs; matrices representation; algebraic and spectral graph theory; graph symmetries.</li> <li>• The agreement protocol - the static case: undirected and directed networks; agreement and markov chains; the Factorization Lemma.</li> <li>• The agreement protocol - Lyapunov and LaSalle: agreement via Lyapunov functions, agreement over switching digraphs, edge agreement, generalizations to nonlinear systems.</li> <li>• Formation Control: formation specification-shapes and relative states; shape based control; relative state based control, dynamic formation selection, assigning roles.</li> <li>• Mobile Robots: Cooperative robotics; weighted graph based feedback; dynamic graphs; formation control revisited; the coverage problem.</li> </ul> |
| 3 | <b>Course prerequisites</b>                                      | Linear Algebra. Linear control systems. Stability theory for linear control systems.  |
| 4 | <b>Teaching methods and language</b>                             | <p>Lectures and exercises.</p> <p><b>Language:</b> English</p> <p><b>Reference textbooks</b></p> <ul style="list-style-type: none"> <li>• M. Mesbahi and M. Egerstedt, <i>Graph Theoretic Methods in Multiagent Networks</i>. Princeton University Press. 2010. <a href="http://press.princeton.edu/titles/9230.html">http://press.princeton.edu/titles/9230.html</a></li> </ul>  |
| 5 | <b>Assessment methods</b>  | Written and oral exam   |