

**PhD in Mathematics and Applications**  
**“Necessary conditions for Optimal Control:**  
**an introduction based on set-separation”**

a.a. 2018/19 (6CFU)

From March 19th to April 10th, 2019 a PhD course in Control Theory will be held at the Department of Mathematics and Applications R. Caccioppoli. The course will have the duration of n. 20 hours and can be recognized for the purposes of educational credits related to the activities of the doctorate. The course will be held by Prof. Franco Rampazzo and introduced by Prof. Lina Mallozzi and Prof. Gabriella Zecca according to the following schedule:

- Lecture 1** (19/03/19, 11:00-13:00), Prof.ssa Mallozzi
- Lecture 2** (22/03/19, 11:00-13:00), Prof.ssa Mallozzi
- Lecture 3** (25/03/19, 10:00-12:00), Prof.ssa Zecca
- Lecture 4** (28/03/19, 10:00-12:00), Prof.ssa Zecca
- Lecture 5** (03/04/19, 9:00-11:00), Prof. Rampazzo
- Lecture 6** (04/04/19, 9:00-11:00), Prof. Rampazzo
- Lecture 7** (05/04/19, 14:00-16:00), Prof. Rampazzo
- Lecture 8** (08/04/19, 9:00-11:00), Prof. Rampazzo
- Lecture 9** (09/04/19, 9:00-11:00), Prof. Rampazzo
- Lecture 10** (10/04/19, 9:00-11:00), Prof. Rampazzo

Classes will be held in the meeting room, I level of the DMA, Monte Sant'Angelo Building 5, at the times indicated.

**Course description.** The course focuses on the celebrated Pontryagin Maximum Principle, which consists in some general necessary conditions for minima of Optimal Control problems. The latter generalize Calculus of Variations' problems, in that the velocities are dynamically constrained by ODE's with control parameters. The main proof we will present relies on a strong, intuitive, geometric idea, namely set-separation, which in turn is made precise by a suitable application of general tools such as cones' transversality and a directional open mapping theorem. Time permitting, some issues from Geometric Control theory will be mentioned (e.g. Lie brackets), as well as connections with Hamilton-Jacobi PDE's.

During the days of the course Prof. F. Rampazzo will be available at the University of Naples for all those who wish to look into some subjects in greater depth. Furthermore, at the beginning of the course detailed lecture notes will be available.

PhD Program Coordinator  
Prof. Carlo Sbordone