Bilinear Control and Numerics for Wave and Schrödinger-like Equations

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Abstract. In this lecture we shall discuss several topics related with the analysis, numerical simulation and control of models involving wave or Schödinger-like equations. In particular we some comment on the problem of bilinear control.

Control Theory is by now and old subject, ubiquitous in many areas of Science and Technology. Recently the interest in Control Theory has grown also in the field of Quantum Chemistry. There is by now a quite well-established finite-dimensional theory and many progresses have been done also in the context of PDE (Partial Differential Equations). But gluing these two pieces together is often a hard task from a mathematical point of view, and the state of the art does not allow to answer to some of the most basic control theoretical questions arising in the context of Quantum Chemistry.

In this talk we shall describe some of the mathematical tools that might be of use when attacking control problems in Quantum Chemistry, but also some of the major dfficulties one encounters when address them.

In particular, we shall discuss some simple bilinear controllability problems for the wave and Schrödinger equations. We shall first analyze their linearized versions. We shall see how the lack of spectral gap makes it very hard to get conclusive theoretical results. We shall also illustrate the difficulties one encounters when attacking these problems from a numerical point of view, and some possible ways for their resolution.