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Dispersion as an obstruction to the bilinear control of Schrödinger equations

The control of quantum systems is an area of intense theoretical and experimental study with significant potential ramifications for technology, of which quantum computing is only the most widely publicized one. The present paper is part of a project on identifying limitations to what can be accomplished by the application of classical fields, in particular whether control can be achieved in arbitrarily small time. The fundamental equation of quantum theory, the Schrödinger equation, is a dispersive PDE. The purpose of this talk is to demonstrate that dispersion can act as an obstacle to controllability that prevents a large class of quantum systems (defined by decay or integrability conditions of the potential) from being controllable in finite time. There is also a large class of systems that cannot not even be controlled in infinite time.