## A complex mathematical model of competition in leukemia with immune response - an optimal control approach

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This paper investigates an optimal control problem associated with a complex nonlinear system of multiple delay differential equations modeling the development of healthy and leukemic cell populations incorporating the immune system. The model takes into account space competition between normal cells and leukemic cells at two phases of the development of hematopoietic cells. The control problem consists in optimizing the treatment effect while minimizing the side effects. In this respect, a function modeling the treatment approach of the disease is considered, allowing the investigation of the most appropriate cure protocol. In order to derive the optimal strategy a discretizaton scheme is applied and the delayed optimal control problem is transformed into a large-scale nonlinear programming problem. By applying the Pontryagin minimum principle, necessary optimality conditions are established and important conclusions about the character of the optimal therapy strategy are drawn.