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Linear Differential Equations with Fuzzy Boundary Values

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In this study, we consider a linear differential equation with fuzzy boundary values. We express the solution of the problem in terms of a fuzzy set of crisp real functions. Each real function from the solution set satisfies differential equation, and its boundary values belong to intervals, determined by the corresponding fuzzy numbers. The least possibility among possibilities of boundary values in corresponding fuzzy sets is defined as the possibility of the real function in the fuzzy solution. In order to find the fuzzy solution we propose a method based on the properties of linear transformations. We show that, if the corresponding crisp problem has a unique solution then the fuzzy problem has unique solution too. We also prove that if the boundary values are triangular fuzzy numbers, then the value of the solution at any time is also a triangular fuzzy number. We find that the fuzzy solution determined by our method is the same as the one that is obtained from solution of crisp problem by the application of the extension principle. We present two examples describing the proposed method.

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