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# An operator theoretical approach to nonlocal differential equations

Joshua Padgett

*Texas Tech University*

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**ABSTRACT.** Nonlocal differential equations are receiving increasing attention due to their ability to accurately model many physically relevant phenomena such as anomalous diffusion and non-Fickian transport. The resulting models exhibit difficulties not seen in standard local models and require careful treatment and attention. In an effort to study problems more efficiently, we consider an operator theoretical approach to solving such problems. This method attempts to mirror the classical approach of solving differential equations through semigroup theory, however, nonlocal problems will have solutions generated by generalized Mittag-Leffler functions. Properties of these operators will be discussed and compared with classical semigroup operators. The theory will be well-motivated through an explicit example of interest. Proposed future considerations will also be briefly mentioned in order to give an idea of research potential.