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# Bivariate nonlinear fractal approximation in Lebesgue spaces

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## Abstract

In a recent paper, construction of fractal surfaces is viewed as a framework to associate a parameterized family of self-referential functions with a prescribed continuous bivariate function on a rectangular region. In this study, first we develop a closely related theme that provides a family of self-referential functions corresponding to a bivariate Lebesgue integrable function. Some approximation theoretic aspects of these self-referential functions that are close to the germ function are considered. Our methods are based in part on similar results established by the first author when the germ function is univariate. Further, we study the bivariate fractal operator that maps the germ function to its self-referential counterpart. These results on fractal operator are perhaps of independent interest as the previous works on univariate counterparts in Lebesgue spaces had been obtained only in the setting of bounded linear maps.

**MSC:** 28A80, 41A05, 41A63, 47H14, 47J25.

**Keywords:** bivariate fractal interpolation,  $\alpha$ -fractal function,  $\mathcal{L}^p$ -spaces, nonlinear fractal operator, Müntz space, Schauder bases and frames.

## §1. Introduction

The functions used in the field of approximation theory are in general smooth, and do not fit the erratic behaviour of some current social and experimental phenomena. In the

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