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Dawei Lu, Lixin Song, Yang Yu

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# Some quicker continued fraction approximations and inequalities towards Euler's constant

Dawei Lu

*School of Mathematical Sciences, Dalian University of Technology, Dalian 116023, China.*

*Department of Statistics, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong.*

Lixin Song\*

*School of Mathematical Sciences, Dalian University of Technology, Dalian 116023, China.*

Yang Yu

*School of Mathematical Sciences, Dalian University of Technology, Dalian 116023, China.*

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## Abstract

In this paper, we define some new continued fraction sequences towards Euler's constant and two related inequalities. We also present some numerical simulations to demonstrate the superiority of the optimal new sequences over new sequences with other coefficients and Lu's sequences at the end of this article.

*Key words:* Euler's constant; continued fraction; rate of convergence; asymptotic expansion; inequalities.

*2000 MSC:* 11Y60; 11A55; 41A25; 34E05; 33F05.

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## 1. Introduction

As it is known to us, defining some new approximations towards fundamental constants plays an important role in field of mathematical constants. One of the most famous constants is Euler's constant, which is denoted as

$$\gamma = 0.577215\dots$$

And we also know that sequence  $\gamma_n$  is defined as

$$\gamma_n = \sum_{k=1}^n \frac{1}{k} - \ln n, \quad (1.1)$$

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*Email addresses:* ludawei\_dlut@163.com (Dawei Lu), lxsong@dlut.edu.cn (Lixin Song\*), yuyang\_dut@163.com (Yang Yu)

\*Corresponding author.

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