
Amirkabir University of Technology
(Tehran Polytechnic)

# Mellin Transform

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# Table of Contents

# Introduction

- Brief introduction to Mellin Transform.
- Applications in mathematical analysis.
- Why mellin transform?

# Mathematical Background

- Key mathematical definitions.
- Important integral formulas.

$$\mathcal{M}\{f(x)\}(s) = \int_0^\infty x^{s-1} f(x)\, dx \tag{1}$$

$$\Gamma(s) = \int_0^\infty x^{s-1} e^{-x}\, dx \tag{2}$$

# Property Proof

- Linearity of Mellin Transform.
- Scaling properties.

$$\mathcal{M}\{x^a f(x)\}(s) = \mathcal{M}\{f(x)\}(s+a). \tag{3}$$

$$\mathcal{M}\{f(ax)\}(s) = a^{-s}\mathcal{M}\{f(x)\}(s). \tag{4}$$

# Examples

- Examples.

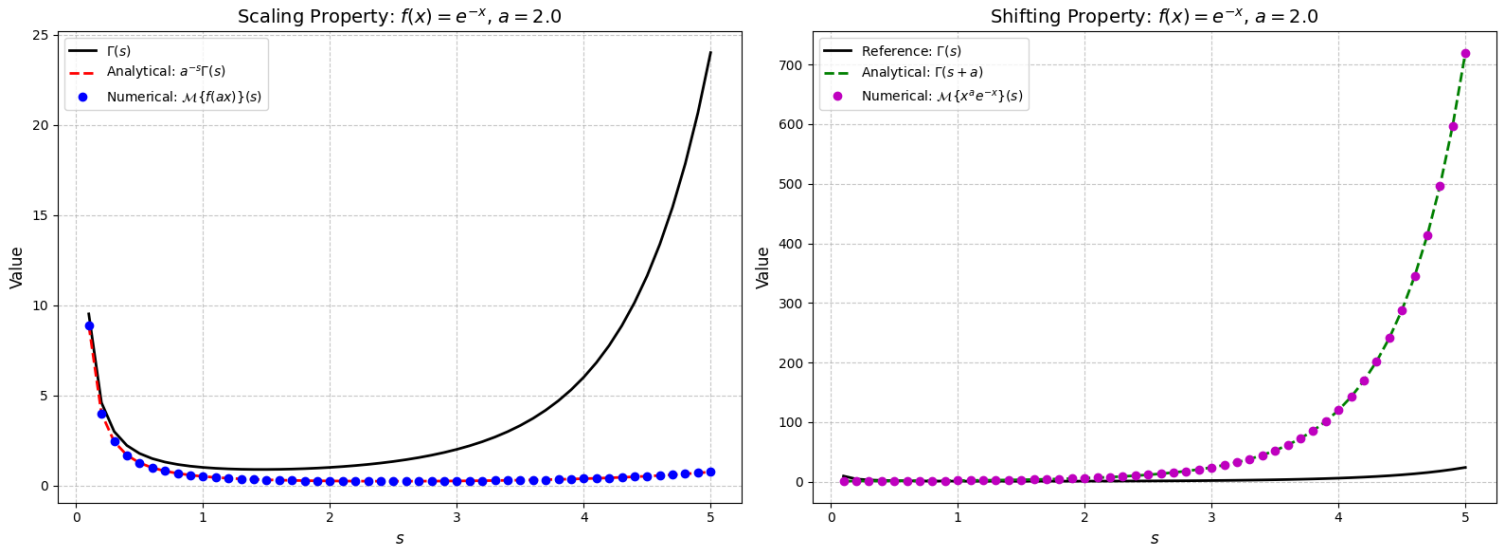


**Figure 1:**Shifting and Scaling Plots

# Gamma and Mellin Transform Relations

- Connection between Gamma functions and Mellin Transform.
- Relation of arithmetic number factorial and gamma function.

if $f(x) = e^{-x}$:

$$\mathcal{M}\{e^{-x}\}(s) = \int_0^\infty x^{s-1} e^{-x}\, dx = \Gamma(s). \tag{5}$$

$$n! = \Gamma(n+1) \tag{6}$$

# Case Study Result

- Description of the case study.

$$r^2\phi_{rr} + r\phi_r + \phi_{\theta\theta} = 0 \tag{7}$$

$$\phi(r,\alpha) = f(r), \quad \phi(r,-\alpha) = g(r), \quad 0 \le r < \infty, \tag{8}$$

$$\phi(r,\theta) \to 0 \quad \text{as} \quad r \to \infty \quad \text{for all} \quad \theta \in (-\alpha,\alpha). \tag{9}$$

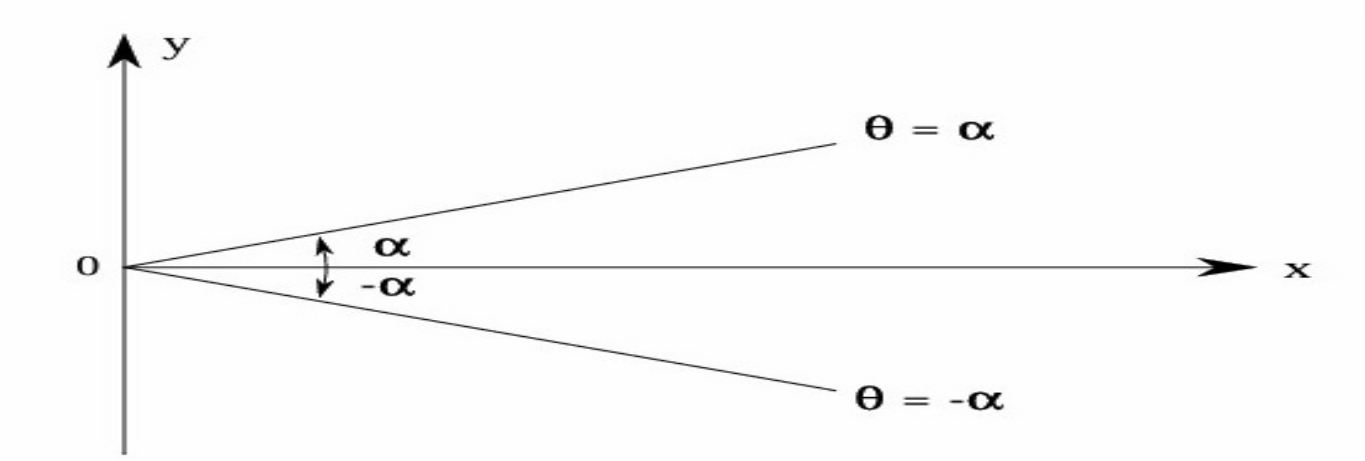


**Figure 2:**Infinite Wedge

# Plot

- Plot for phi in designated variables.

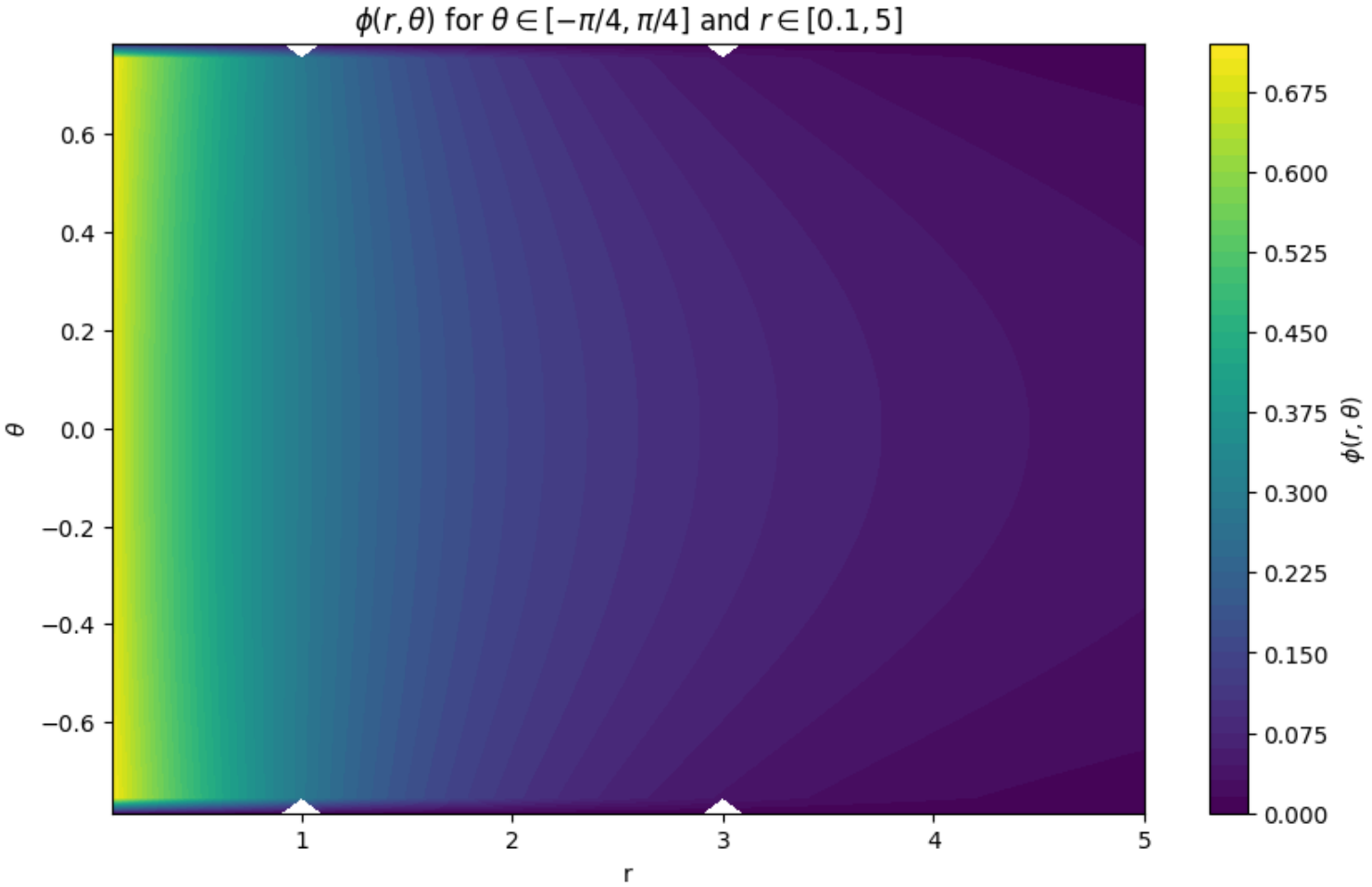


**Figure 3:**Phi plot

# Conclusion

- Summary of key takeaways.

# References


- Debnath, Lokenath, and Dambaru Bhatta.*/ Transforms and Their Applications. 2nd ed.*,CRC Press, 1995.
- Github link,*Mellin-transform* at `https://github.com/MohammadMahdiElyasi/Mellin-transform`.

# Outro

**Thank you for your attention!**


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