

# SELECTED TOPICS In Aerospace Engineering

EDITOR

ERWIN SULAEMAN



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INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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***ALTERNATE EXPANSION SERIES FOR THE  
INCOMPLETE CYLINDRICAL FUNCTION***

**21.1. Introduction**

**T**his chapter describes an alternate expansion series as an analytical solution to the incomplete cylindrical function. The present alternate series exposes separation between singular and regular functions occurring in the kernel function. This work presents a summary of [34] and its further improvement in [35].

**21.2. Separation of Real and Imaginary Functions**

It has been described in Chapter 29 that the analytical solution to the incomplete cylindrical function of order  $n$  has been given by Ueda [37] as follows:

$$B_\nu = B_{\nu,real} + i B_{\nu,imag} \quad (21.1)$$

where

$$B_{\nu,real} = \sum_{n=0}^{\infty} (-1)^n U_{\nu,2n} + \frac{(-k^2/2)^\nu}{(2\nu-1)!!} \sum_{n=0}^{\infty} p_n \frac{(kr/2)^{2n}}{n!(n+\nu)!}$$

$$B_{\nu,imag} = \sum_{n=0}^{\infty} (-1)^n U_{\nu,2n+1} - \frac{\pi}{2} \frac{(-k^2/2)^\nu}{(2\nu-1)!!} \sum_{n=0}^{\infty} \frac{(kr/2)^{2n}}{n!(n+\nu)!} \quad (21.2)$$

$$p_n = -\left(\gamma + \ln \frac{k}{2}\right) + \sum_{m=1}^n \frac{1}{m} + \sum_{m=n+1}^{n+\nu} \frac{1}{2m}$$

and the recursive term  $U_m$  is defined in Eq. (21.17).