

SELECTED TOPICS In Aerospace Engineering

EDITOR

ERWIN SULAEMAN



IIUM Press

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011
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Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

ISBN: 978-967-418-145-1

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN.BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan
Tel: **+603-6188 1542 / 44 / 45** Fax: **+603-6188 1543**
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ANALYTICAL DERIVATION OF THE INCOMPLETE CYLINDRICAL FUNCTIONS: IMAGINARY PART

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Following the evaluation of its real counter part in the previous chapter, the imaginary part of the incomplete cylindrical functions is described in the present chapter. The combination of the real and imaginary parts are therefore the analytical solution to the incomplete cylindrical function occurring in the kernel function of unsteady lifting surface aerodynamics.

Recall the definition of the imaginary part as presented in previous chapter:

$$\begin{aligned} B_{ni} &= \int_{-\infty}^X \frac{\sin ku}{(r^2 + u^2)^{n+\frac{1}{2}}} du \\ &= \int_0^X \frac{\sin ku}{(r^2 + u^2)^{n+1/2}} du - \int_0^{\infty} \frac{\sin ku}{(r^2 + u^2)^{n+1/2}} du \end{aligned} \quad (20.1)$$

where it has two segments: the first segment which has a finite subinterval $[0, X]$ of the integral limit, and the second segment which has infinite subinterval $[0, \infty]$ of the integral limit. In general, the proof for this imaginary part of the integral is easier than the real part since one deals only with one set of singular functions.

20.2 The finite subinterval of the integral