

Title	Analysis of circular wing lattice (on a successive approximation method using mapping function)
Sub Title	
Author	八田, 昭雄(Hatta, Akio)
Publisher	慶應義塾大学藤原記念工学部
Publication year	1966
Jtitle	Proceedings of the Fujihara Memorial Faculty of Engineering Keio University (慶應義塾大学藤原記念工学部研究報告). Vol.19, No.76 (1966.) ,p.221(3)- 221(3)
JaLC DOI	
Abstract	
Notes	Summaries of Doctor and Master Theses Master of Engineering, 1966
Genre	Departmental Bulletin Paper
URL	https://koara.lib.keio.ac.jp/xoonips/modules/xoonips/detail.php?koara_id=KO50001004-00190076-0003

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Analysis of Circular Wing Lattice

(On a Successive Approximation Method Using Mapping Function)

Akio HATTA*

This paper deals with one of the analysis of fixed circular wing lattice which is seen as the guide vanes of reaction type water turbine or as the diffusers of blowers. The flow around the lattice is thought as two dimensional potential flow. It is known that the circular wing lattice composed of logarithmic spirals can be transformed into a unit circle using mapping function.

By adding some regular series to this function we can also transform the circular wing lattice composed of thin aerofoils with arbitrary shape into a unit circle. It is considered to be a hard work to determine successively all the unknown factors in this mapping function. A new successive approximation method stated in this paper will be easily performed using a digital computer.

And the complex potential function expressing the flow around the circle can be determined in order to satisfy the flow around the circular wing lattice. Then the circulation around each aerofoils can be calculated by the hypothesis of Kutta-Jowkowski. And pressure distribution on the surface of each aerofoil is expressed in a more simplified formula than before.

Numerical calculations by this method show good coincidence with the test results reported by others.

The author investigates further following items

- i) Characteristics of the logarithmic spirals set in many dispositions.
- ii) Characteristics of the aerofoils with arbitrary shape set in several dispositions.

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