Rotor 38

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Original model

Rotor 38 is part of a research program to study a advanced-core compressor design with a high compression ratio (20:1). It is therefore the fourth stage rotor of this eight stage transonic compressor. Of these eight stages, the first four have been designed and tested : rotors 35, 36, 37 and 38. For more information, here is a link to report from NASA.

- Original technical report [(cite:moore1982design>Moore. «Performance of Single-Stage Axial-Flow Transonic Compressor With Rotor and Stator Aspect Ratios of 1.63 and 1.77, Respectively, and With Design Pressure Ratio of 2.05 » 1982. pdf)]:

```
@TechReport{moore1982design,
author      = {Moore, R. D. and Reid, Lonnie},
title       = {Performance of Single-Stage Axial-Flow Transonic Compressor
With Rotor and Stator Aspect Ratios of 1.63 and 1.77, Respectively, and
With Design Pressure Ratio of 2.05},
institution = {NASA Lewis Research Center Cleveland, OH, United States},
note        = {NASA-TP-2001, url~:
\url{https://ntrs.nasa.gov/citations/19820014395}, 1982}}
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- Picture :

Fig1. https://catalog.archives.gov/id/17466806

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@Misc{brown1977records,
author   = {Brown, M.},
title    = {Rotor 35 - Rotor 38 - Stator 35 in casing. {R}ecords of the
{N}ational {A}eronautics and {S}pace {A}dministration, 1903 - 2006.
{P}hotographs relating to agency activities, facilities and personnel, 1973 -
2013},
note     =
{\href{https://catalog.archives.gov/id/17466806}{https://catalog.archives.gov/
id/17466806}, 1977 }, % for Fig. 1}
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Useful documents

- PDF of the NASA report : rotor38.pdf
- CSV file of the blade geometry : rotor38_original.csv

Geometry

The geometry of rotor 38 is described in the original NASA report by the following tables. The length are in centimeters and the angles in degrees.

Aerodynamic design

	unit	values
pressure ratio	[-]	2.05
mass flow	[kg/s]	20.2
tip speed	[m/s]	455
tip solidity	[-]	1.3
aspect ratio	[-]	1.63
number of blades	[-]	48
rotative speed	[rad/s]	1800

Material properties

Rotor 38 is made of a 200-grade maraging steel

	unité	valeurs
alloy	[-]	18-Ni-200-maraging
Young's modulus	[GPa]	180
density	[kg/m3]	8000
Poisson's ratio	[-]	0.3
yield stress	[GPa]	1.38

First three natural frequencies (with clamped root) for the mesh:

1. (1B): 3773.4 rad/s / 600.5 Hz
2. (1T): 13583.8 rad/s / 2161.9 Hz
3. (2B): 14937.7 rad/s / 2377.4 Hz

CAD

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Modèle original

Le rotor 38 appartient à un programme de recherche visant à étudier une conception de compresseur possédant un grand taux de compression (20:1). Il est donc le rotor du quatrième étage de ce compresseur transsonique de huit étages. Parmi ces huit étages, les quatre premiers ont été conçus et testés, ils correspondent aux rotors 35, 36, 37 et 38. Pour plus d'information, voici un lien vers rapport de la NASA.

- Rapport technique original[(cite:moore1982design>Moore. «Performance of Single-Stage Axial-Flow Transonic Compressor With Rotor and Stator Aspect Ratios of 1.63 and 1.77, Respectively, and With Design Pressure Ratio of 2.05 » 1982. pdf)]:

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- Photographie :

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id/17466806}, 1977 }, % for Fig. 1}
```

Documents utiles

- PDF du rapport de la NASA : rotor38.pdf
- Fichier CSV de la géométrie : rotor38_original.csv

Géométrie

La géométrie du rotor 38 est décrite dans le rapport d'origine de la NASA par les tableaux suivants. Les grandeurs sont en centimètres et en degrés.

Caractéristiques aérodynamiques

	unités	valeurs
taux de compression	[-]	2,05
débit massique	[kg/s]	20,2
vitesse en tête	[m/s]	455
solidité en tête	[-]	1,3
allongement	[-]	1,63
nombre d'aubes	[-]	48
vitesse de rotation	[rad/s]	1800

Propriétés matériau

Le matériau du rotor 38 est un alliage à base de nickel : un acier maraging de grade 200

	unité	valeurs
alliage	[-]	18-Ni-200-maraging
module d'Young	[GPa]	180
masse volumique	[kg/m3]	8000
coefficient de Poisson	[-]	0,3
limite élastique	[GPa]	1,38

Fréquences des trois premiers modes (noeuds de la base encastrés) pour le maillage :

1. (1B): 3773,4 rad/s / 600,5 Hz
2. (1T): 13583,8 rad/s / 2161,9 Hz
3. (2B): 14937,7 rad/s / 2377,4 Hz

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Document issu de la page wiki:
https://wiki.lava.polymtl.ca/public/modeles/rotor_38/accueil?rev=1663337445

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