Rotor 66

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Original model

Rotor 66 is part of a 51 centimeter-diameter, five-stage compressor having a design weight flow of 29.7 kilograms per second with a pressure ratio of 9.27. Performance data obtained from tests indicated that the first stage was not meeting its design performance.

- Original technical report [(cite:urasek1976design>Urasek. «Performance of inlet stage of transonic compressor» 1976 pdf)]:

```
@TechReport{urasek1976design,
author      = {Urasek, Donald C. and Steinke, Ronald J. and Lewis, George
W.},
title       = {Performance of inlet stage of transonic compressor},
institution = {NASA Lewis Research Center Cleveland, OH, United States},
note        = {NASA-TM X-3345, url~:
\url{https://ntrs.nasa.gov/citations/19760009935}, 1976}}
```

- Picture :

Fig1. https://catalog.archives.gov/id/17423368

```
@Misc{brown1974records,
author   = {Brown, M.},
title    = {First stage rotor wheel from 5 stage compressor. {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/17423368}{https://catalog.archives.gov/
id/17423368}, 1974 }, % for Fig. 1}
```

Useful documents

- PDF of the NASA report : rotor66.pdf
- CSV file of the blade geometry : rotor66_original.csv

Geometry

The geometry of rotor 66 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	[-]	1.61
mass flow	[kg/s]	29.7
tip speed	[m/s]	426
tip solidity	[-]	1.4
aspect ratio	[-]	3.1
number of blades	[-]	57
rotative speed	[rad/s]	1679.94

Material properties

The original material of the rotor 66 is not defined in the NASA report.

Considered properties: Ti-6Al-4V, generic titanium :

	unité	valeurs
alloy	[-]	Ti-6Al-4V
Young's modulus	[GPa]	108
density	[kg/m3]	4400
Poisson's ratio	[-]	0.34
yield stress	[GPa]	0.824

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

1. (1B): 1342.0 rad/s / 213.6 Hz
2. (2B): 4557.2 rad/s / 725.3 Hz
3. (1T): 8209.0 rad/s / 1306.5 Hz

CAD

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Modèle original

Le rotor 66 fait partie d'un compresseur à cinq étages de 51 centimètres de diamètre ayant un débit nominal de 29,7 kilogrammes par seconde et un taux de compression de 9,27. Les données de performance obtenues lors de tests ont indiqué que le premier étage n'atteignait pas ses performances de conception.

- Rapport technique original [(cite:urasek1976design>Urasek. «Performance of inlet stage of transonic compressor» 1976 pdf)]:

```
@TechReport{urasek1976design,
author      = {Urasek, Donald C. and Steinke, Ronald J. and Lewis, George
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title       = {Performance of inlet stage of transonic compressor},
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note        = {NASA-TM X-3345, url~:
\url{https://ntrs.nasa.gov/citations/19760009935}, 1976}}
```

- Photographie :

Fig1. https://catalog.archives.gov/id/17423368

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@Misc{brown1974records,
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{N}ational {A}eronautics and {S}pace {A}dministration, 1903 - 2006.
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2013},
note     =
{\href{https://catalog.archives.gov/id/17423368}{https://catalog.archives.gov/
id/17423368}, 1974 }, % for Fig. 1}
```

Documents utiles

- PDF du rapport de la NASA :

rotor66.pdf

- Fichier CSV de la géométrie :

rotor66_original.csv

Géométrie

La géométrie du rotor 66 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	[-]	1,61
débit massique	[kg/s]	29,7
vitesse en tête	[m/s]	426
solidité en tête	[-]	1,4
allongement	[-]	3,1
nombre d'aubes	[-]	57
vitesse de rotation	[rad/s]	1679,94

Propriétés matériau

Le matériau original du rotor 66 n'est pas défini dans le rapport de la NASA.

Propriétés considérées : alliage de titane Ti-6Al-4v :

	unité	valeurs
alliage	[-]	Ti-6Al-4v
module d'Young	[GPa]	108
masse volumique	[kg/m3]	4400
coefficient de Poisson	[-]	0,34
limite élastique	[GPa]	0,824

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

1. (1B): 1342,0 rad/s / 213,6 Hz
2. (2B): 4557,2 rad/s / 725,3 Hz
3. (1T): 8209,0 rad/s / 1306,5 Hz

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Document issu de la page wiki:
https://wiki.lava.polymtl.ca/public/modeles/rotor_66/accueil?rev=1663337315

Dernière mise à jour: **2023/04/05 08:59**