Global Journal of Engineering and Technology [GJET].
ISSN: **2583-3359** (Online)
Frequency: Monthly
Published By GSAR Publishers
Journal Homepage Link- https://gsarpublishers.com/journal-gjet-home/

SIMULATION OF TWO STAGE TWIN SCREW COMPRESSOR INCLUDING LEAKAGE FLOWS AND COMPRASION

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Article History
Received: 31/03/2022
Accepted: 03/04/2022
Published: 05/04/2022
Vol – 1 Issue – 1
PP: - 40-42

Abstract.

This paper gives the method of creating the numerical version for a sample screw compressor provided by using Sullair for studies functions. The favored simulation technique has to be able to supply sufficient accuracy at a viable effort in terms of computational time and manpower to create the numerical version.

Keywords: *Polyethylene terephthalate bottle blowing system, water-flooded single-screw compressor, dehumidification, pressure loss, isentropic efficiency.*

Introduction

Computational Fluid Dynamics (CFD) is a not unusual and tested simulation technique in studies and enterprise for the evaluation of fluid structures. within the beyond years, it has demonstrated to come to be an increasing number of applicable for modeling the flow physics internal fine displacement (PD) machines. The running chamber and consequently the discretized float domain of PD machines are converting in time, characterized by means of complex thermodynamics. Compressible fluids, real-gas houses and leakage flows with trans- or supersonic characteristics are phenomena which have to be accounted for in order to properly model the conduct of the system. As CFD methods evolve in trendy, but additionally for the application of PD machines specifically, the numerical version can replace a prototype for the duration of early tiers of the product improvement. it's miles a dry walking stage twin screw compressor jogging with air at a rated energy variety between 190 and 300 kW. the two degrees are equipment driven by means of the primary shaft at rotational speeds between 1180 and 2100 rev/min. each level functions extraordinary rotor profiles, in which the first stage has a 4-five, the second one degree a 7-nine lobe mixture. the whole stress ratio of the two degrees combined is up to 10:1. To beautify the overall performance of the compressor, discharged air from the primary level is cooled down before entering the second one stage. A particular meshing approach is used to model the size-converting running chambers between rotors and casing, where most effective hexahedral cells are used and mesh topology is steady. The model bills for radial and axial clearances between rotors and stator, where rotors and stator are connected with interfaces. The brief simulation results are compared to experimental measurements for torque, and go with the flow price. also discharge stress and temperature after first and 2d degree are as compared to the experimental effects. in addition, the possibilities of the simulation are exemplified by means of the gathering of time- and area-resolved reveal points like temperature or strain at wonderful points within the compressor. other than direct contrast to the experiment, additionally a sensitivity takes a look at regarding the trade of housing clearances is supplied, as leakage float has severe effect on the compressor overall performance. these clearances and the resulting leakages are regularly now not exactly acknowledged whereas in addition they vary due to production tolerances or deformations because of the burden on rotors and stator. right here, the numerical simulation can serve as a helpful device to estimate the sensitivity and exchange of gadget traits, that is difficult to determine inside the scope of experiments given that method, it needs to be taken into consideration that both compressor ranges are modeled in one simulation setup, where the physical time step within the transient simulation is identical for the complete version.

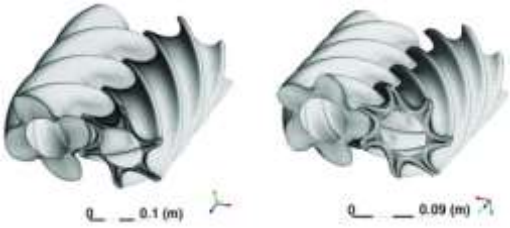

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Figure 1. Grids for first stage (top) and second stage (bottom) of the compressor

Thus, angle increments of the generated grids cannot be chosen arbitrarily for each stage. The ratio of angle increments for both stages has to represent the speed ratio of the two male rotors. The tooth pitch angles and angle increments for both stages are given in the following table:

Table 1. Angle increments according to the speed ratio of the modeled two stage screw compressor

Stage 1	Stage 2
Speed ratio (Stage 2/Stage 1)	1.53
Tooth pitch angle	90° 72°
Number of grids per pitch angle	90 47
Angle increment	1° 1.532°
Angle increment ratio (Stage2/Stage1)	1.532

The case is set up for three different operating points (OP), where the rotational speed of the stages is varied as well as inlet (first stage suction port) and outlet temperature (second stage discharge port, temperature is only used in case of backflow) according to the conditions indicated by experimental data. In addition, one case with smaller housing clearances (uniformly decreased by approximately 20%) and smaller intermesh clearance (closest distance between the rotors decreased by approximately 50%) for each stage is simulated, while axial clearances remain unchanged

Table 2 shows the four operating points taken into account:

Case	Main shaft speed [rev/min]	Inlet Pressure [bar(a)]	Outlet pressure [bar(a)]	Inlet temp. 1st stage [C]	Inlet temp. 2nd stage [C]	Outlet temp. 2nd stage [C]
OP1	1490	1.0	7.98	30.8	31.9	136.1
OP2	1790	1.0	7.98	28.6	34.1	143.0
OP3	2100	1.0	7.98	27.0	37.9	150.8
OP4 (Decreased radial clearances)	1790	1.0	7.89	28.6	34.1	143.0

For both stages of the screw compressor, the compression inside the working chamber is visualized in Figure 2 by the instantaneous pressure distribution on the rotor walls. It is shown over one pitch angle of the corresponding stage. At the depicted rotor positions (0° to 60° for the first stage, 0° to 49° for the second stage), the pressure in the rotor chambers formed by male and female rotor lobes increases as the volume of the individual chambers is decreasing. Once the lobes reach the control edges, the connection of the chambers with the discharge port is established and compression process is finished.

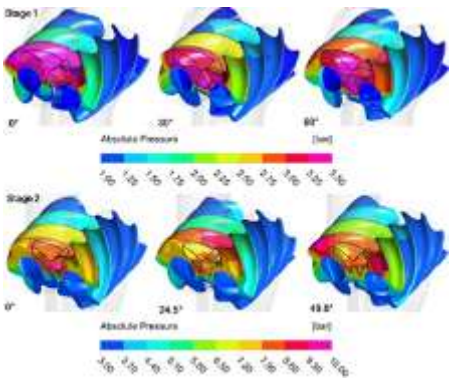

Figure 2. Pressure distribution at 1790 rpm for first (top) and second stage (bottom) over one pitch angle

Conclusion

This paper shows a CFD approach to simulate the sample dry screw compressor provided by Sullair. This compressor consists of two compressor stages with an intermediate cooler. In the presented approach, both stages as well as the interstage cooling are modeled within one setup, allowing a direct coupling of the stages without the need to specify boundary conditions at the outlet of the first stage or at the inlet of the second stage respectively. The cooler is replaced with a simple duct, where the temperature drops (i. e. a specified suction temperature for the second stage is reached) is realized with an energy sink

References

1. Сакун И.А. Винтовыекомрессоры – Ленинград: Машиностроение, 1970;
2. Tracton A.A. Coatings technology – USA, Taylor & Francis Group, 2007, 371p;

*Corresponding Author: Fayzullaev Asomiddin Aloviddinovich

3. Asthana R., Kumar A., Dahotre N. Materials science in manufacturing – Elsevier, 2006, - 630p.;
4. Harsha Sree K.S., Principles of physical vapor deposition of thin films - Elsevier, San Jose State University, CA, USA, 2006, - 1160p.;
5. Krella A., Czyzniewski A. Cavitation erosion resistance of nanocristalline TiN coating deposited on stainless steel – Elsevier, published in Wear, vol. 265, 2008, 963-970p.;
6. Carvalho N.J.M., Zoestbergen E, Kooi B.J., De Hosson J.Th.M. Stress analysis and microstructure af PVD monolayer TiN and multilayer TiN/(Ti,Al)N coatings – Elsevier, published in Thin solid films, vol. 426, 2003, - 179-189p.;
7. Zaytsev D., Development of wet compressor for applications in compression-resorption heat pumps, Ph. D. Thesis, Delft University of Technology, The Netherlands, 2003, 208p.;
8. Ferreira Carlos A. Infante, Zaytsev D., and Zamfirescu C., Wet Compression of Pure Refrigerants - 2006., International Compressor Engineering Conference. Paper 1778.
9. Norkhudjayev F. R., Mukhamedov A. A., Tukhtasheva M. N., Bektemirov B. Sh., & Gopirov M. M. INFLUENCE OF NITROCEMENTATION MODES ON THE CHANGE IN THE HARDNESS OF THE SURFACE LAYER OF STRUCTURALSTEELS. JournalNX-A Multidisciplinary Peer Reviewed Journal ISSN No: 2581 -4230 VOLUME 7, ISSUE 11, Nov. -2021. P. 75-77.
10. Bektemirov B. S., Ulashov J. Z., Akhmedov A. K., & Gopirov M. M. (2021, June). TYPES OF ADVANCED CUTTING TOOL MATERIALS AND THEIR PROPERTIES. In *Euro-Asia Conferences* (Vol. 5, No. 1, pp. 260-262).
11. Ziyamukhamedova Umida Alijanovna, Bakirov Lutfillo Yuldoshaliyevich, Miradullaeva Gavkhar Bakpulatovna, & Bektemirov Begali Shukhrat Ugli (2018). Some Scientific and technological principles of development of composite polymer materials and coatings of them forcotton machine. European science review, (3-4), 130-135.
12. Karimov, Sh.A., Mamirov, Sh.Sh., Khabibullayeva, I.A., Bektemirov, B.Sh., Khusanov N.: Friction and wear processes in tribotechnical system. International Journal of Mechatronics and Applied Mechanics, 2021, Issue 10, Vol. I, ISSN: 2559-6497, P 204-208.