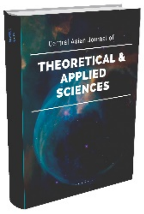

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Flow Around a Plate at Nonzero Cavitation Numbers

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Annotation: *This article discusses the issue of flow around a plate at nonzero cavitation numbers. A review is made of the difference of the cavitation numbers from zero even when flowing around the simplest outlines, which greatly complicates the mathematical analysis of the problem. The drag coefficient for the transverse flow around the plate is expressed by the same row according to the Ryabushinsky scheme. At low cavitation numbers, the Zhukovsky-Roshko scheme is considered. The formulas are given according to the Ryabushinsky scheme.*

Keywords: *flow, cavitation, Ryabushinsky scheme, Zhukovsky-Roshko scheme, flat cavities, cavitating body, Linear dependence, drag coefficient, lift coefficient.*

The difference between the cavitation number and zero even when flowing around a body of the simplest outlines (plate) greatly complicates the mathematical analysis of the problem. We will restrict ourselves to discussing the most important results useful for understanding the physical aspects of the problem and their application to the analysis of spatial problems.

The drag coefficient for the transverse flow around the plate, calculated according to the scheme with a return stream and according to the Ryabushinsky scheme, is expressed by the same series:

$$C_x(\sigma) = \frac{2\pi}{\pi+4}\left[1+\sigma+\frac{\sigma^2}{8(\pi+4)}+O(\sigma^3)\right] \qquad (1)$$

In the case of the Zhukovsky-Roshko scheme, in the third term in brackets, the number 8 is replaced by the number 6. As you can see, for small numbers of cavitation, one can take

$$C_x(\sigma) = \frac{2\pi}{\pi+4}(1+\sigma), \qquad (2)$$

where $C_x(0) = \frac{2\pi}{\pi+4} = 0{,}88$.

At $\sigma = 1$ the accuracy of this approximate formula is 0.8%, and as it decreases, its accuracy increases.

Analytical behavior of the boundaries of flat cavities at $\sigma \to 0$ at large distances from the cavitating body obeys the law:

$$y - y_0 \approx C_1\sqrt{x} + C_2 \ln x + O\left(x^{-\frac{1}{2}} \ln x\right) \quad (3)$$

Рябушинского, оцениваются формулами: The dimensions of the cavity, calculated according to the Ryabushinsky scheme, are estimated by the formulas:

a) cavity width:

$$\frac{B}{l} \approx \frac{4}{4+\pi}\left(\frac{2+\sigma}{\sigma} + \frac{\pi}{4}\right) \quad (4)$$

б) cavity length:

$$\frac{L}{l} \approx \frac{4}{4+\pi}\left[\left(\frac{2+\sigma}{\sigma}\right)^2 - \frac{1}{2}\ln 4\frac{2+\sigma}{\sigma} - \frac{1}{4}\right] \quad (5)$$

в) cavity lengthening:

$$\lambda = \frac{L}{B} \approx \frac{2}{\sigma} \quad (6)$$

The error in calculating the cavity width does not exceed 0.6% at $\sigma \pi 3$. Formula (5) gives overestimated results of the cavity length by 0.7% at $\sigma = 1$.

Similar numerical estimates for the configuration of cavities are obtained using other schemes.

The linear dependence of the drag coefficient on the cavitation number is also characteristic of the lift coefficient. The same pattern turns out to be valid in spatial flows. Thus, the most important role of the Kirchhoff model is emphasized, although at first glance it is unrealistic, because in reality there can be no infinite caverns.

Along with the above, it must be emphasized that the dependence $C_x(\sigma) = C_x(0)(1+\sigma)$ well reflects the force interaction with the flow of strongly blunt bodies, the image of which was a plate installed across the flow. For pointed bodies, the linear dependence of the forces on the cavitation number is preserved, but it is more accurate to write it in the form

$$C_x(\sigma) = C_x(0)(1+\beta\sigma) \quad (7)$$

where β —a correction factor depending on the shape of the body. Wherein $C_x(0)$, naturally also depends on the configuration of the body. A particular example is the well-known Betz formula (1931) for sharp wedges (cones):

$$C_x(\sigma) = C_x(0) + \sigma \quad (8)$$

REFERENCES

1. Абдукаримов, Б. А., Аббасов, Ё. С., & Усмонова, Н. У. (2019). Исследование рабочих параметров солнечных воздухонагревателей способы повышения их эффективности. *Матрица научного познания*, (2), 37-42.
2. Усмонова, Н. А., Негматуллоев, З. Т., Нишонов, Ф. Х., & Усмонов, А. А. (2019). Модели закрученных потоков в строительстве Каркидонского водохранилища. *Достижения науки и образования*, (12 (53)).

3. Jovliev, O. T., Khujakulova, M. K., Usmonova, N. A., & O‘tbosarov, S. R. (2021). Modeling the Theory of Liquid Motion Variable on the Way Flow. *Middle European Scientific Bulletin*, *18*, 455-461.
4. Usmonova, N. A. (2021). Structural Characteristics of the Cavern at a Fine Bubbled Stage of Cavitation. *Middle European Scientific Bulletin*, *18*, 95-101.
5. Ishankulovich, K. S., & Akramovna, U. N. (2021). Simulation of the Lift of Two Sequential Gate Valves of the Karkidon Reservoir. *Middle European Scientific Bulletin*, *18*, 148-156.
6. Hamdamalievich, S. A., & Nurmuhammad, H. (2021). Analysis of Heat Transfer of Solar Water Collectors. *Middle European Scientific Bulletin*, *18*, 60-65.
7. Usmonova, N. A., & Khudaykulov, S. I. (2021, April). SPATIAL CAVERNS IN FLOWS WITH THEIR PERTURBATIONS IMPACT ON THE SAFETY OF THE KARKIDON RESERVOIR. In *E-Conference Globe* (pp. 126-130).
8. Сатторов, А. Х., Акрамов, А. А. У., & Абдуразаков, А. М. (2020). Повышение эффективности калорифера, используемого в системе вентиляции. *Достижения науки и образования*, (5 (59)), 9-12.
9. Serikbaev, B., & Butayarov, A. (2020, July). Operational responsibility and operational reliability of cotton drip irrigation systems. In IOP Conference Series: Materials Science and Engineering (Vol. 883, No. 1, p. 012037). IOP Publishing.
10. Serikbaev, B., Butayarov, A., Gulamov, S., & Dustnazarova, S. (2021). Inflation of water to the soil in the fields of drop irrigation. In E3S Web of Conferences (Vol. 264). EDP Sciences.
11. Maqsudov R. I., qizi Abdukhalilova S. B. Improving Support for the Process of the Thermal Convection Process by Installing //Middle European Scientific Bulletin. – 2021. – Т. 18. – С. 56-59.
12. ugli Mo‘minov O. A., Maqsudov R. I., qizi Abdukhalilova S. B. Analysis of Convective Finns to Increase the Efficiency of Radiators used in Heating Systems //Middle European Scientific Bulletin. – 2021. – Т. 18. – С. 84-89.
13. Muratovich, D. S. (2016). Study of functioning of reservoirs in the form of cylindrical shells. *European science review*, (9-10).
14. Mamadalievich, M. M., & Erkinjonovich, A. Z. Principles of Operation and Account of Hydraulic Taran. JournalNX, 1-4.
15. АБДУЛҲАЕВ, З., & МАДРАХИМОВ, М. (2020). Гидротурбиналар ва Насосларда Кавитация Ҳодисаси, Оқибатлари ва Уларни Бартараф Этиш Усуллари. Ўзбекгидроэнергетика” илмий-техник журнали, 4(8), 19-20.
16. Madraximov, M. M., Abdulxayev, Z. E., Yunusaliev, E. M., & Akramov, A. A. (2020). Suyuqlik Va Gaz Mexanikasi Fanidan Masalalar To’plami. Oliy o ‘quv yurtlari talabalari uchun o ‘quv qo ‘llanma.-Farg’ona, 285-291.
17. Malikov, Zafar Mamatkulovich, and Murodil Erkinjanovich Madaliev. "Mathematical modeling of a turbulent flow in a centrifugal separator." *Vestnik Tomskogo Gosudarstvennogo Universiteta. Matematika i Mekhanika* 71 (2021): 121-138.
18. Мадрахимов, М. М., & Абдулҳаев, З. Э. (2019). Насос агрегатини ишга туширишда босимли сув узатгичлардаги ўтиш жараёнларини ҳисоблаш усуллари. Фарғона Политехника Институти Илмий–Техника Журнали, 23(3), 56-60.

Volume: 02 Issue: 12 | Dec 2021, ISSN: 2660-5317

19. Mirzoev, Akmal Ahadovich, Murodil Madaliev, and Doniyor Yakhshibayev Sultanbayevich. "Numerical modeling of non-stationary turbulent flow with double barrier based on two liquid turbulence model." In *2020 International Conference on Information Science and Communications Technologies (ICISCT)*, pp. 1-7. IEEE, 2020.
20. Абдукаримов, Б. А., Акрамов, А. А. У., & Абдухалилова, Ш. Б. К. (2019). Исследование повышения коэффициента полезного действия солнечных воздухонагревателей. Достижения науки и образования, (2 (43)).
21. Мадалиев, Муродил Эркинжон Угли. "Численное исследование осесимметричных струйных течений на основе турбулентной модели νt-92." *Вестник Южно-Уральского государственного университета. Серия: Вычислительная математика и информатика* 9, no. 4 (2020).
22. Erkinjonovich, Abdulkhaev Zokhidjon, and Madraximov Mamadali Mamadaliyevich. "WATER CONSUMPTION CONTROL CALCULATION IN HYDRAULIC RAM DEVICE." In E-Conference Globe, pp. 119-122. 2021.
23. Madaliev, M. E. U., Maksudov, R. I., Mullaev, I. I., Abdullaev, B. K., & Haidarov, A. R. (2021). Investigation of the Influence of the Computational Grid for Turbulent Flow. Middle European Scientific Bulletin, 18, 111-118.
24. Madaliev, E. U., Madaliev, M. E. U., Mullaev, I. I., Shoev, M. A. U., & Ibrokhimov, A. R. U. (2021). Comparison of Turbulence Models for the Problem of an Asymmetric Two-Dimensional Plane Diffuser. Middle European Scientific Bulletin, 18, 119-127.
25. Abdukarimov, B. A., Sh R. O'tbosarov, and M. M. Tursunaliyev. "Increasing Performance Efficiency by Investigating the Surface of the Solar Air Heater Collector." *NM Safarov and A. Alinazarov. Use of environmentally friendly energy sources* (2014).
26. Madaliev, M. E. U., Rakhmankulov, S. A., & Tursunaliev, M. M. U. (2021). Comparison of Finite-Difference Schemes for the Burgers Problem. Middle European Scientific Bulletin, 18, 76-83.
27. Усаров, М. К., and Г. И. Маматисаев. "Вынужденные колебания коробчатой конструкции панельных зданий при динамических воздействиях." *Проблемы механики* 2 (2010): 23-25.
28. Усаров, М. К., and Г. И. Маматисаев. "Свободные колебания коробчатой конструкции здания." *Проблемы механики.* 5-6 (2009): 31.
29. Usarov, M., G. Mamatisaev, G. Ayubov, D. Usarov, and D. Khodzhaev. "Dynamic calculation of boxed design of buildings." In *IOP Conference Series: Materials Science and Engineering*, vol. 883, no. 1, p. 012186. IOP Publishing, 2020.
30. Abdulkhaev, Z. E., M. M. Madraximov, and M. A. O. Shoyev. "Reducing the Level of Groundwater In The City of Fergana." *Int. J. Adv. Res. Sci. Commun. Technol* 2, no. 2 (2021): 67-72.
31. Erkinjonovich, A. Z., Mamadaliyevich, M. M., O'G'Li, S. M. A., & Egamberdiyevich, T. N. (2021). FARG'ONA SHAHAR YER OSTI SIZOT SUVLARINING KO'TARILISH MUAMMOSI VA YECHIMLARI. Oriental renaissance: Innovative, educational, natural and social sciences, 1(3), 138-144.
32. Abdulkhaev, Z., Madraximov, M., Abdurazaqov, A., & Shoyev, M. (2021). Heat Calculations of Water Cooling Tower. Uzbekistan Journal of Engineering and Technology.
33. Рашидов, Ю. К., Исмоилов, М. М., Орзиматов, Ж. Т., Рашидов, К. Ю., & Каршиев, Ш. Ш. (2019). Повышение эффективности плоских солнечных коллекторов в системах

теплоснабжения путём оптимизации их режимных параметров. In Экологическая, промышленная и энергетическая безопасность-2019 (pp. 1366-1371).

34. Рашидов, Ю. К., Орзиматов, Ж. Т., & Исмоилов, М. М. (2019). Воздушные солнечные коллекторы: перспективы применения в условиях Узбекистана. In Экологическая, промышленная и энергетическая безопасность-2019 (pp. 1388-1390).
35. Рашидов, Ю. К., Исмоилов, М. М., Рашидов, К. Ю., & Файзиев, З. Ф. (2019). Определение оптимального количества расчётных слоев многослойного водяного стратификационного аккумулятора теплоты при расчете саморегулирующегося активного элемента. In Экологическая, промышленная и энергетическая безопасность-2019 (pp. 1372-1376).
36. Abdullayev, B. X., S. I. Xudayqulov, and S. M. Sattorov. "SIMULATION OF COLLECTOR WATER DISCHARGES INTO THE WATERCOURSE OF THE FERGHANA VALLEY." *Scientific-technical journal* 24, no. 3 (2020): 36-41.
37. Abdullayev, B. X., S. I. Xudayqulov, and S. M. Sattorov. "VARIABLE FLOW RATE FLOW ALONG A PATH IN A CLOSED INCLINED PIPELINE." *Scientific-technical journal* 24, no. 4 (2020): 23-28.
38. Abdulkhaev, Z. E., Madraximov, M. M., Rahmankulov, S. A., & Sattorov, A. M. (2021, June). Increasing the efficiency of solar collectors installed in the building. In " ONLINE-CONFERENCES" PLATFORM (pp. 174-177).
39. Xamdamaliyevich, Sattorov Alimardon, and Salimjon Azamdjanovich Rahmankulov. "INVESTIGATION OF HEAT TRANSFER PROCESSES OF SOLAR WATER, AIR CONTACT COLLECTOR." In *E-Conference Globe*, pp. 161-165. 2021.
40. Madaliev, M. E. U., Rakhmankulov, S. A., Shoev, M. A. U., & Ibrokhimov, A. R. U. (2021). Modeling of Deformation Processes and Flow of Highly Concentrated Suspensions in Cylindrical Pipelines. Middle European Scientific Bulletin, 18, 128-136.

