Chapter 14
The Rise of the First Commercial CFD Codes: PHOENICS, FLUENT, FIDAP, CFX, FLOW-3D, and STAR-CD

14.1 PHOENICS Code

The CFD code development group at Imperial College headed by D.B. Spalding began multiphase flow modeling in the mid- and late 1970s [1]. Spalding developed the interphase slip algorithm (IPSA) to solve the PDEs contained in the PHOENICS code, debuting in 1978, which Runchal [1] claims "…was the first commercially available tool in CFD." Runchel makes extensive reference to the influence of the Group T-3 at LANL on multiphase flow, but does not mention the SLOOP code development work at ANC. This is in spite of the fact Spalding was quite aware of it as evidenced by his consulting at ANC in the early 1970s and his participation in Dimitri's 1976 NSF workshop [2] and the 1979 EPRI workshop [3] discussed in Chap. 8. The Web site for the PHOENICS code is http://www.cham.co.uk. Spaulding died just short of his 94th birthday on November 27, 2016 [4]. Hence, another giant in the area of CFD has left us, the first being Francis H. Harlow on July 1, 2016, whom I discussed in Chap. 5.

14.2 FLUENT, FIDAP, CFX, and FLOW-3D Codes

The FLUENT code started in 1983 by a small group at Creare, Inc., an engineering consulting firm in Etna, NH. The first commercial version was called CREARE X. It was developed by Prof. James Swithenbank and his team, including Ferit Boysan, at Sheffield University in the UK. The first version allowed for two- or three-dimensional structured grids using Cartesian or polar coordinates, steady-state flow, laminar or turbulent conditions, heat transfer, three-component combustion, a dispersed phase, natural convection, and an easy-to-use interactive front end. The first sale of FLUENT was made in December. In 1984, six more licenses were sold. Boysan launched Flow Simulations Ltd., in Sheffield UK, which later became

R.W. Lyczkowski, *The History of Multiphase Science and Computational Fluid Dynamics*, Mechanical Engineering Series,
https://doi.org/10.1007/978-3-319-66502-3_14

Fluent Europe. In 1988, the Fluent group at Creare, Inc., formed a new company, Fluent, Inc., headquartered nearby in Lebanon, New Hampshire. In 1995, Fluent, Inc., was acquired by Aavid Thermal Technologies and became a wholly owned subsidiary. In May 1996, Fluent, Inc., acquired Fluid Dynamics International located in Evanston, Illinois, which developed the FIDAP finite-element code and in 1997 acquired Polyflow S.A., developer of the POLYFLOW code. As mentioned in Chap. 13, Madhava Syamlal was instrumental in the transfer of multiphase technology developed in the MFIX code into Fluent in 1997. It includes Dimitri's granular flow model [5], unstructured mesh capabilities for transient and steady state, and serial and parallel computations.

The CFX code, formerly named FLOW-3D, was developed at the United Kingdom Atomic Energy Authority at Harwell and in 1996 was privatized in the US at AEA Technology Software Engineering, Inc. The reason for the name change was that Tony Hirt, who founded Flow Science, Inc., in 1980 when he left LASL, had previously trademarked their FLOW-3D code in several countries. He convinced AEA Technology Software Engineering, Inc., to change the name to CFX. Their documentation clearly showed that they had prior use of the name. Tony sold Flow Science, Inc., in 2000 and now devotes his time to developing novel applications for FLOW-3D. Their Web site is at www.flow3d.com. ANSYS, Inc., acquired CFX in 2003, and it is now called ANSYS® CFX®. AEA Technology Software Ltd., located in Waterloo Ontario Canada appears to continue licensing its own version of CFX. Fluent become the largest supplier of commercial CFD software in the world and in May 2006 was also acquired by ANSYS, Inc. The development of Fluent has continued to the present version now called ANSYS® FLUENT® 18.0 having moving geometry, large eddy simulation (LES) turbulence modeling, and solution optimization. For a full list of ANSYS capabilities, the reader is encouraged to visit the ANSYS Web site at www.ansys.com.

14.3 STAR-CD

In the middle of 1980s, David Gosman together with Dr. Raad Issa formed Computational Dynamics Ltd., with the aim of developing an unstructured body-fitted industrial CFD code. Adapco, a New York-based structural engineering consultancy company, backed Computational Dynamics to produce a commercial body-fitted CFD code named STAR-CD® (which stands for Simulating Transport in Arbitrary Regions). The first version was block-structured but, by its second release in 1991, STAR-CD had been recreated to become the first truly unstructured commercial code, offering engineers the ability to construct meshes from any combination of hexahedral, tetrahedral, and prismatic cells and thereby providing geometrical and meshing flexibility. STAR-CD quickly became the default CFD code for the simulation of engine combustion problems.

References

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