Swimming Simulation: A New Tool for Swimming Research and Practical Applications

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Abstract This chapter covers topics in swimming simulation from a computational fluid dynamics perspective. This perspective means emphasis on the fluid mechanics and CFD methodology applied in swimming research. We concentrated on numerical simulation results, considering the scientific simulation point-of-view and especially the practical implications with swimmers.

1 Introduction

Swimming is one of the major athletic sports and many efforts are being made to establish new records in all events. To swim faster, thrust should be maximized and drag should be minimized. These aims are difficult to achieve because swimmers surge, heave, roll and pitch during every stroke cycle. In addition, measurements of human forces and mechanical power are difficult due to the restrictions of measuring devices and the specificity of aquatic environment. Thus, human swimming evaluation is one of the most complex but outstanding and interesting topics in sport biomechanics. Over the past decades, research in swimming biomechanics has evolved from the study of swimmer's kinematics to a flow dynamics approach, following the line of research from the experimental biology [1, 2]. Significant efforts have been made to understand swimming mechanics on a deeper basis. In the past, most of the studies involved experimental data, nowadays the numerical solutions can give new insights about swimming science. Computational fluid dynamics (CFD) methodology is one of the different methods that have been applied in swimming research to observe and understand water movements around the human body and its application to improve swimming technique and/or swimming equipments and therefore, swimming performance. One recent example is the

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