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Supporting system interference on aerodynamic characteristics of an aircraft model in a low-speed wind tunnel

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Abstract Many kinds of support system, such as tail support system, external/balance support system, side wall support system and wing tip support system are used for wind tunnel testing. The difference between the flow around the test model and the flow around the real aircraft is caused by the support system and results in a difference between aerodynamic characteristics of the test article and the actual one and is referred to as support interference. Support interference is one of the important topics of aerodynamic testing since it can have significant influence on the accuracy of the test data. The support system and support interference become one of the main investigation areas of experiment aerodynamics. The results of experimental investigation of the influence of model support on the determination of aerodynamic coefficients of a wind tunnel model are presented. A discussion is given of the forms of interference occurring in the low speed wind tunnel of the Military Technical Institute due to the model support system. Two types of model attachments, bent sting and external/balance model support are considered. The magnitude of interference on the test results is given. The main interference is on the pitching moment coefficient C_m. The computational results of the interference-free aerodynamic coefficients of a Training Aircraft Model are also given and compared to experimental data. A procedure for eliminating the undesired effect of interference of the model support system on the test results is presented.

Keywords: Support Interference, Wind tunnel, Training Aircraft Model, CFD

Nomenclature

C_D	=	drag force coefficient	q	=	dynamic pressure, bar
C_L	=	lift force coefficient	Re	=	Reynolds number
C_m	=	pitching moment coefficient	F.S.	=	Transducer full scale
C_{mf}	=	flap hinge moment coefficient	X_r	=	distance beetwen point of reduction and front of model,m
L	=	length of model, m	X_{ref}	=	distance beetwen point of reduction and virtual center of balance, m
l_{mac}	=	mean aerodynamically chord, m	C	=	coefficient of model without support interference
S_{ref}	=	wing area, m^2	ΔC_L	=	relative difference of lift force coefficients of model mounted on BS and TEM
M	=	Mach number	ΔC_m	=	relative difference of pitching moment coefficients of model mounted on BS sting and TEM
p_{st}	=	static pressure, bar			
p_0	=	total pressure, bar			
T_0	=	total temperature, K			
V	=	velocity, m/s			
i	=	number of measurements with dummy support, i=1,2,3;			