

Direction and incidence angles

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Mr R.M. Taunton	— British Aircraft Corporation (Guided Weapons) Ltd
Mr C.F. Toms	— Hawker Siddeley Aviation Ltd, Hatfield.

The members of the staff of ESDU concerned were:

Mr A.J. Ward Smith	— Head of Fluid Mechanics and Thermodynamics Group
Mr D. Herbert	— Fluid Mechanics and Thermodynamics Group.

The Dynamics Committee, which first met in January 1962, has the co-operation of many engineers and scientists in industry, research establishments and universities from whom much assistance and unpublished information is being received.

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DIRECTION AND INCIDENCE ANGLES

1. INTRODUCTION

It is often necessary to specify the direction of a vector with respect to an axis system. For this purpose only two angles are required, and these are called "direction angles". This Item considers pairs of such angles that define the directions of $\vec{V}$ and $\vec{V}^K$ with respect to body or normal earth axes.

The direction angles of $\vec{V}$ with respect to body axes are commonly called incidence angles. Relationships are established between these and the attitude angles Φ, Θ, Ψ and Φ_a, Θ_a, Ψ_a . Free-flight model experiments and wind-tunnel tests are examples of the type of work in which such relations are used. The wind-tunnel application is briefly discussed in Section 5.

2. NOTATION

l_1, m_1, n_1	}	direction cosines of body axes relative to normal earth axes
l_2, m_2, n_2		
l_3, m_3, n_3		
l_a, m_a, n_a		direction cosines of $\vec{V}$ relative to normal earth axes
S, S_{a0}, S_{bc}		axes-transformation matrices
S_a		incidence matrix
$\vec{V}$		aircraft velocity relative to air
$\vec{V}^K$		aircraft velocity relative to earth
α_t, β_s	}	direction angles of $\vec{V}$ with respect to body axes, <i>i.e.</i> incidence angles
α_s, β_t		
σ, λ		
γ, χ		direction angles of $\vec{V}^K$ relative to normal earth axes
γ_a, χ_a		direction angles of $\vec{V}$ relative to normal earth axes
Φ, Θ, Ψ		attitude angles of body axes relative to normal earth axes
Φ_a, Θ_a, Ψ_a		attitude angles of air-path axes relative to normal earth axes

For other notation see Item 67002^[2].

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