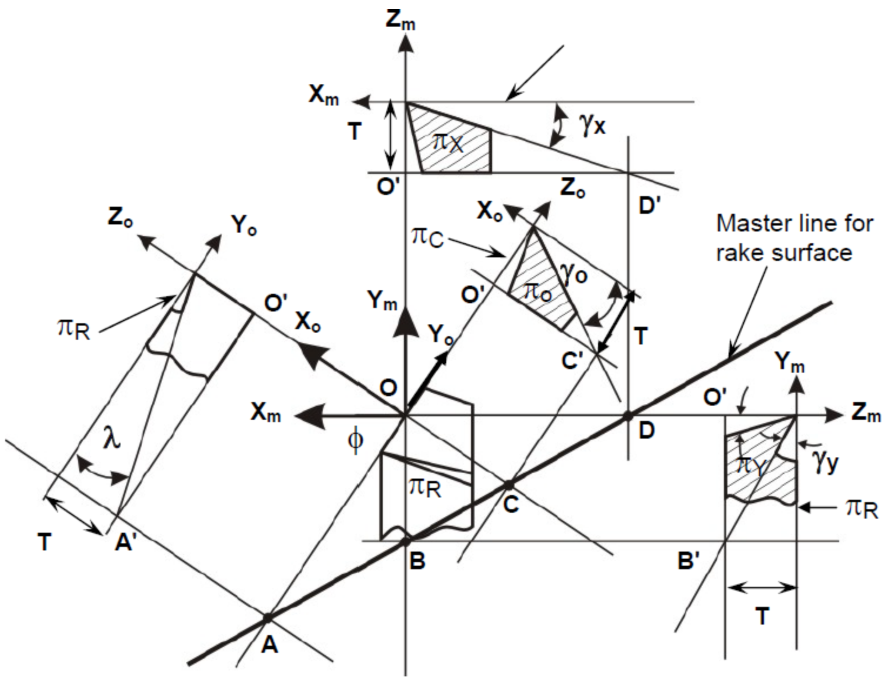
Conversion of Angles by Graphical Method

2.4.1.1. Conversion of angles of single point tools by graphical method

Conversion of rake angles

The concept and construction of ML for the tool rake surface is shown in Fig



In Fig, the rake surface, when extended along π_X plane, meets the tool's bottom surface (which is parallel to π_R) at point D' i.e. D in the plan view. Similarly when the same tool rake surface is extended along π_Y, it meets the tool's bottom surface at point B' i.e., at B in plan view. Therefore, the straight line obtained by joining B and D is nothing but the line of intersection of the rake surface with the tool's bottom surface which is also parallel to π_R. Hence, if the rake surface is extended in any direction, its meeting point with the tool's bottom plane must be situated on the line of intersection, i.e., BD. Thus the points C and A (in Fig. 4.1) obtained by extending the rake surface along π_o and π_C respectively upto the tool's bottom surface, will be situated on that line of intersection, BD.

This line of intersection, BD between the rake surface and a plane parallel to π_R is called the "Master line of the rake surface".

From the diagram in Fig.

OD = $T\cot\gamma_X$

OB = $T\cot\gamma_Y$

OC = $T\cot\gamma_o$

$OA = T\cot\lambda$

Where, T = thickness of the tool shank.

Conversion of tool rake angles from ORS to ASA

γ_o and λ (in ORS) = f (γ_x and γ_y of ASA system)
Proof of Equation 4.1:
With respect to Fig. 4.2,
Consider, ΔOBD = Δ OBC + Δ OCD
Or, ½ OB.OD = ½ OB.CE + ½ OD.CF
Or, ½ OB.OD = ½ OB.OCsinφ + ½ OD.OCcosφ
Dividing both sides by ½ OB.OD.OC,
1/OC=1/ODsin(fi)+1/OBcos(fi)

Similarly Equation 4.2 can be proved considering;
Δ OAD = Δ OAB + Δ OBD
i.e., ½ OD.AG = ½ OB.OG + ½ OB.OD
where, AG = OAsinφ
and OG = OAcosφ
Now dividing both sides by ½ OA.OB.OD,
1/OBsinφ=1/ODcosφ+1/OA

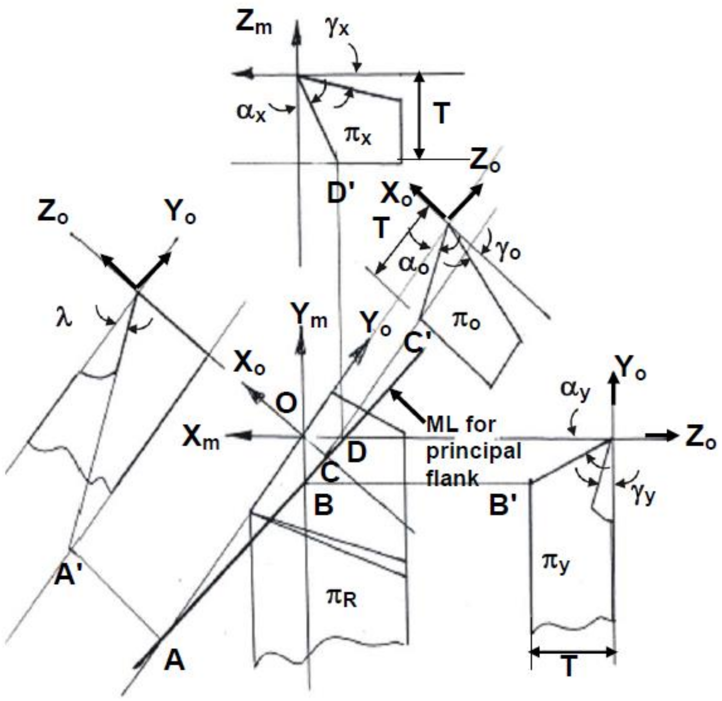
Fig.2.24

Conversion of clearance angle

Conversion of clearance angles from ASA to ORS

Angles, α_o and λ in ORS = f(α_x and α_y in ASA system)

Following the same way used for converting the rake angles taking suitable triangles (in Fig. 4.2), the following expressions can be arrived at using Fig



Conversion of clearance angles from ORS to ASA system

α_x and α_y (in ASA) = f(α_o and λ in ORS)

Proceeding in the same way using Fig. 4.5, the following expressions are derived

cosφsinφocotαxcotαλtan−= (4.14)

and sinφcosφocotαycotαλtan+= (4.15)

The relations (4.14) and (4.15) are also possible to be attained from inversions of Equation 4.13 as indicated in case of rake angles.

Determination of minimum clearance and setting angle

Minimum clearance, α_{min} or α_m

The magnitude and direction of minimum clearance of a single point tool may be evaluated from the line segment OM taken normal to the Master line (Fig. 4.5) as OM = tanα_m

The values of α_m and the orientation angle, φ_α (Fig. 4.5) of the principal flank are useful for conveniently grinding the principal flank surface to sharpen the principal cutting edge.

Proceeding in the same way and using Fig. 4.5, the following expressions could be developed to evaluate the values of α_m and φ_α

Similarly the clearance angles and the grinding angles of the auxiliary flank surface can also be derived and evaluated.

o Interrelationship amongst the cutting angles used in ASA and ORS

The relations are very simple as follows:

φ (in ORS) = 90^o - φ_s (in ASA) (4.20)

and φ_1(in ORS) = φ_e (in ASA) (4.21)