THE ANGLE BETWEEN TWO REAL PLANS

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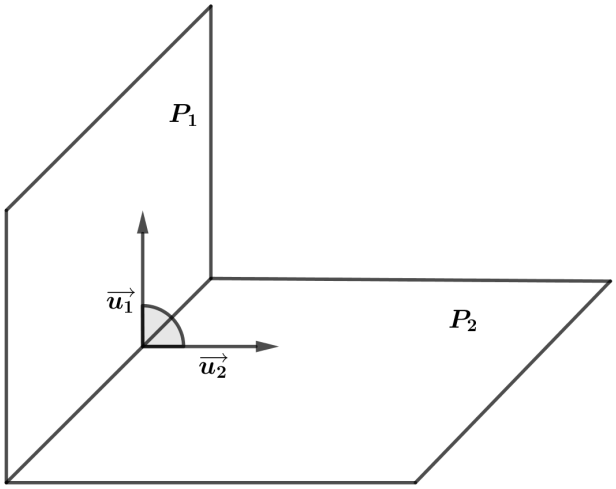
Let be the real plans:

$$P_1 : x + 2y - 3z + 1 = 0$$
$$P_2 : 5x - 3y + 4z - 2 = 0$$

The normal vectors of P_1, P_2 are:

$$\overrightarrow{u_1}(1, 2, -3) = \overrightarrow{i} + 2\overrightarrow{j} - 3\overrightarrow{k}$$
$$\overrightarrow{u_2}(5, -3, 4) = 5\overrightarrow{i} - 3\overrightarrow{j} + 4\overrightarrow{k}$$



$$\overrightarrow{u_1} \cdot \overrightarrow{u_2} = 1 \cdot 5 + 2 \cdot (-3) - 3 \cdot 4 = 5 - 6 - 12 = -13$$
$$|\overrightarrow{u_1}| = \sqrt{1^2 + 2^2 + (-3)^2} = \sqrt{1 + 4 + 9} = \sqrt{14}$$
$$|\overrightarrow{u_2}| = \sqrt{5^2 + (-3)^2 + 4^2} = \sqrt{25 + 9 + 16} = \sqrt{50} = 5\sqrt{2}$$
$$\cos(\angle(P_1, P_2)) = \cos(\angle(\overrightarrow{u_1}, \overrightarrow{u_2})) =$$
$$= \frac{\overrightarrow{u_1} \cdot \overrightarrow{u_2}}{|\overrightarrow{u_1}| \cdot |\overrightarrow{u_2}|} = \frac{-13}{\sqrt{14} \cdot 5\sqrt{2}} = \frac{-13}{10\sqrt{7}} = \frac{-13\sqrt{7}}{70}$$

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