$$\alpha_1 = \sin\lambda\cos\beta, \quad \alpha_2 = \sin\lambda\sin\beta, \quad \alpha_3 = \cos\lambda,$$

$$n_1 = \cos\xi\sin\lambda\cos\beta + \sin\xi(\cos\lambda\cos\beta\cos\psi + \sin\beta\sin\psi),$$

$$n_2 = \cos\xi\sin\lambda\sin\beta + \sin\xi(\cos\lambda\sin\beta\cos\psi - \cos\beta\sin\psi),$$

and

$$n_3 = \cos\xi\cos\lambda - \sin\xi\sin\lambda\cos\psi.$$

Since the polycrystal is isotropic,

$$\frac{1}{8\pi^2}\sin\lambda \, d\lambda d\beta d\psi$$

is the probability that the magnetization lies in the range λ to $\lambda + d\lambda$ and β to $\beta + d\beta$ while the strain is in a range ψ to $\psi + d\psi$. The average values of various terms appearing in the energy expression are obtained from

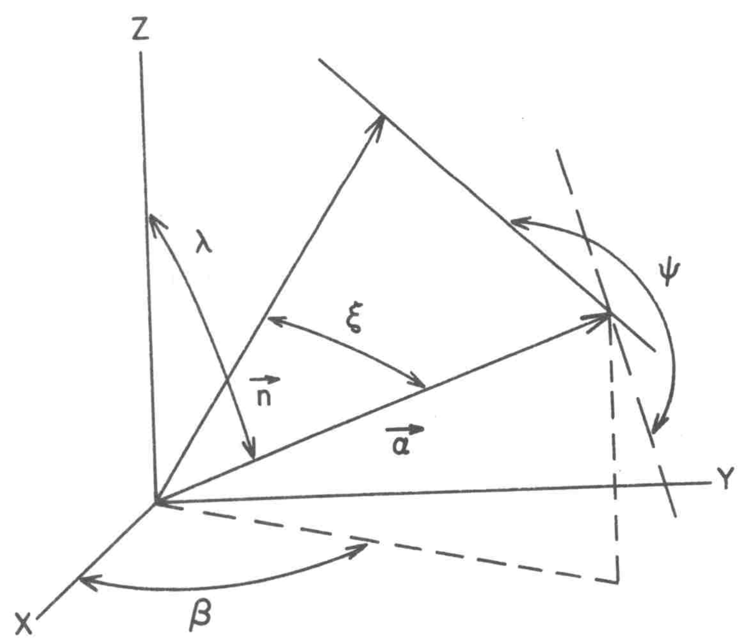

Fig. 3.4.--Independent angular coordinates for representing anisotropy energy.

$$\overline{f}(\xi) = \frac{1}{8\pi^2} \int_0^{\pi}\int_0^{2\pi}\int_0^{2\pi} f(\xi, \lambda, \beta, \psi) \sin\lambda d\lambda d\beta d\psi.$$

Various averages will be required and are tabulated in Table 1.

TABLE 1.--Average values of various terms appearing in the energy expression

$f(\xi, \lambda, \beta, \psi)$	$\overline{f}(\xi)$
$\alpha_1^2\alpha_2^2 + \alpha_2^2\alpha_3^2 + \alpha_3^2\alpha_1^2$	$\frac{1}{5}$
$\alpha_1^2n_1^2 + \alpha_2^2n_2^2 + \alpha_3^2n_3^2$	$\frac{1}{5} + \frac{2}{5}\cos^2\xi$
$\alpha_1\alpha_2n_1n_2 + \alpha_2\alpha_3n_2n_3 + \alpha_3\alpha_1n_3n_1$	$-\frac{1}{10} + \frac{3}{10}\cos^2\xi$
$\alpha_1^2n_1^4 + \alpha_2^2n_2^4 + \alpha_3^2n_3^4$	$\frac{3}{35} + \frac{12}{35}\cos^2\xi$
$\alpha_1\alpha_2n_1n_2n_3^2 + \alpha_2\alpha_3n_2n_3n_1^2 + \alpha_3\alpha_1n_3n_1n_2^2$	$-\frac{1}{70} + \frac{3}{70}\cos^2\xi$
$\alpha_1^2\alpha_2^2n_3^2 + \alpha_2^2\alpha_3^2n_1^2 + \alpha_3^2\alpha_1^2n_2^2$	$\frac{3}{35} - \frac{2}{35}\cos^2\xi$

From this table, the average value of the anisotropy energy from conventional magnetoelastic theory, Equation (3.1), can immediately be written down. It is

$$\mathcal{E}_A = \frac{1}{5}K_1 + Be\cos^2\xi, \qquad (3.10)$$

where

$$B = \frac{2}{5}b_1 + \frac{3}{5}b_2.$$

The crystal anisotropy energy averages to a constant and does not contribute