that this additional interaction is a short-range repulsion coming either from spin fluctuations, or being the renormalized repulsion at the Cu sites.

To the first approximation different regions with the maximal density of states and the maximal absolute value of the order parameter are disconnected. Therefore, the order parameter can be either even, or odd with respect to a $\pi/2$ rotation in the ab-plane. The corresponding formulas are:

$$\frac{\Delta(\varphi)}{\Delta_1} = \frac{2(n-1)P_{0y}}{\kappa^2 d}\left\{\left(\frac{\kappa}{2p_o}\right)^{2n}\left[\sin^{-2n}\left(\frac{\varphi}{2}\right) + \sin^{-2n}\left(\frac{\varphi-\varphi_0}{2}\right)\right] - \frac{U}{g}\right\}, \tag{4, e}$$

$$\frac{\Delta(\varphi)}{\Delta_1} = \frac{2(n-1)P_{0y}}{\kappa^2 d}\left(\frac{\kappa}{2p_o}\right)^{2n}\left[\sin^{-2n}\left(\frac{\varphi}{2}\right) - \sin^{-2n}\left(\frac{|\varphi-\varphi_0|}{2}\right)\right], \tag{4, o}$$

where Δ_1 is the order parameter in the singular region, P_{0y} is the length of the singularity, d is the period in the c-direction, p_o is the radius of the Fermi surface, which we assume cylindrical, 0 and $\varphi_o=\pi/2$ are the locations of singularities, and U is the amplitude of the short-range repulsion, which we suppose isotropic. These expressions are valid far from the singular regions. A simple interpolation permits to describe the whole Fermi surface.

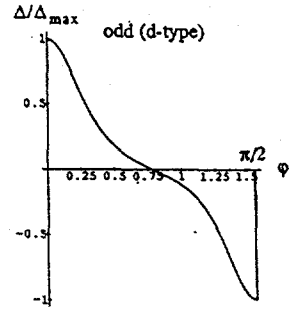

Fig. 6. Plot of Δ/Δ_1 according to eq. (4, o).

Fig.6 presents the plot of eq. (4, o) for some specific choice of constants. The order parameters (4) have the same symmetry, as the"s-wave" and "d-wave" although they differ from the usual expressions. As already said, to the first approximation the even and odd states are degeneratre. This degeneracy is lifted, if we take into account the energy of the small overlap of the order parameter originating from different singular regions. In case, if there were only phonon attraction, the even solution would have definitely the lowest energy. However, the presence of a small short-range repulsion with an isotropic Fourier amplitude in momentum space can drastically change the situation [11].

Applying all the superconducting machinery (see ref.[12]) to the full Hamiltonian, including kinetic terms, we obtain the necessary quantities:

$$T_{c,odd} = 8(\gamma/\pi)\mu_1 \exp[-1/(\lambda_1-\lambda_2] = (\gamma/\pi)\Delta_1 \exp\{-\lambda_2/[\lambda_1(\lambda_1-\lambda_2)]\}$$
$$\approx(\gamma/\pi)\Delta_1 \exp(-\lambda_2/\lambda_1^2),\ T_{c,even} \approx (\gamma/\pi)\Delta_1 \exp(\lambda_2/\lambda_1^2)\ ,\ (\lambda_2 \ll \lambda_1)\ ;$$
$$T_{c,odd} - T_{c,even} \approx -2(\gamma/\pi)\Delta_1 \sinh(\lambda_2/\lambda_1^2)\ ,\ \Delta_1 = 8\mu_1 \exp(-1/\lambda_1)\ . \tag{5}$$

$$\Omega_{odd}(0)-\Omega_{even}(0) \approx \frac{4P_{y0}}{(2\pi)^2 v_1 d}\Delta_1^2 \sinh(\lambda_2/\lambda_1^2) \tag{6}$$

where

$$\lambda_1 = \frac{1}{(2\pi)^2 v_1}\left(\frac{g\kappa^2}{n-1} - \frac{2UP_{y0}}{d}\right),\ \lambda_2 = \frac{2P_{y0}}{(2\pi)^2 v_1 d}\left[g\left(\frac{\kappa^2}{2p_o^2}\right)^n - U\right],\ \mu_1 = \varepsilon_F - \varepsilon_o\ . \tag{7}$$