Collection of Essential Equations

Small load approximation (SLA)	$\frac{\Delta\tilde{f}}{f_0} = \frac{\mathrm{i}}{\pi Z_q}\tilde{Z}_L = \frac{\mathbf{i}}{\pi Z_q}\frac{\langle\tilde{\sigma}_S\rangle_{area}}{\tilde{\mathbf{v}}_S}$
Gordon-Kanazawa-Mason result	$\frac{\Delta\tilde{f}}{f_0} = \frac{-1+\mathrm{i}}{\sqrt{2}\pi Z_q}\sqrt{\omega}\sqrt{\rho_{liq}\eta_{liq}}$
Viscoelastic medium	$\tilde{G}(\omega)\rho = -\left(\pi Z_q \frac{\Delta\tilde{f}}{f_0}\right)^2$
Thin rigid film (Sauerbrey Equation)	$\frac{\Delta\tilde{f}}{f_0} \approx -\frac{2nf_0}{Z_q}m_f = -n\frac{\langle m_f\rangle_{area}}{m_q}$
Viscoelastic film in air	$\frac{\Delta\tilde{f}}{f_0} = \frac{-1}{\pi Z_q}\tilde{Z}_f \tan\left(\tilde{k}_f d_f\right)$
Thin viscoelastic film in air	$\frac{\Delta\tilde{f}}{f_0} = \frac{-\omega m_f}{\pi Z_q}\left[1 + \frac{(n\pi)^2}{3}\left(\frac{J_f}{\rho_f}Z_q^2 - 1\right)\left(\frac{m_f}{m_q}\right)^2\right]$
Viscoelastic film in liquid	$\frac{\Delta\tilde{f}}{f_0} = \frac{-\tilde{Z}_f}{\pi Z_q}\frac{\tilde{Z}_f tan\left(\tilde{k}_f d_f\right) - i\tilde{Z}_{liq}}{\tilde{Z}_f + i\tilde{Z}_{liq} tan\left(\tilde{k}_f d_f\right)}$
Thin film in liquid	$\frac{\Delta\tilde{f}}{f_0} \approx \frac{-\omega m_f}{\pi Z_q}\left[1 - 2\pi i n\frac{\tilde{J}_f(\omega)}{\rho_f}f_0\rho_{liq}\eta_{liq}\right]$
Thin adsorbate in liquid	$\frac{\Delta\tilde{f}}{f_0} \approx -\frac{\rho\omega}{\pi Z_q}\int_0^\infty\left[\frac{\tilde{G}(z)-\tilde{G}_{liq}}{\tilde{G}(z)}\right]\mathrm{d}z$
Contact stiffness	$\Delta f = \frac{1}{n}\frac{N_P}{2\pi^2 Z_q}\kappa_P$
Time averaging	$\frac{\Delta\tilde{f}}{f_0} = \frac{\mathbf{i}}{\pi Z_q}\frac{2\langle\sigma_S(t)\exp(\mathrm{i}\omega t)\rangle_{area,time}}{\tilde{\mathbf{v}}_S}$
SLA in tensor form	$\Delta\tilde{f} \approx \frac{\mathbf{i}}{4\pi\rho_q}\frac{\sum_{ijk}\int_{Surface}\hat{u}_{0,S,i}n_j\tilde{Z}_{L,ijk}(\mathbf{r_S})\hat{u}_{0,S,k}\mathrm{d}^2\mathbf{r}_S}{\sum_k\int_{Volume}\hat{u}_{0,k}\hat{u}_{0,k}\mathrm{d}^3\mathbf{r}}$
Piezoelectric stiffening	$\frac{\Delta\tilde{f}_{PE}}{f_0} = \frac{\mathbf{i}}{A\pi Z_q}4\phi^2\left(\left(\mathrm{i}\omega C_0 + \tilde{Z}_{ex}^{-1}\right)^{-1} - \left(\mathrm{i}\omega C_0 + \tilde{Z}_{ex,ref}^{-1}\right)^{-1}\right)$

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