# DINAMIK BOG‘LIQ TERMOPLASTIKLIK MASALASINI DEFORMATSION NAZARIYASI ASOSIDA SONLI MODELLASHTIRISH

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***Annotatsiya:*** *Ushbu tezisda termoplastiklik masalasini bog‘liq holatda oshkormas va oshkor rekurrent formulalar yordamida sonli modellashtirish ko‘rib chiqiladi.*

***Kalit so‘zlar:*** *termoplastiklik, plastik deformatsiya, temperatura maydoni, kuchlanish, deformatsiya, matematik model, sonli usul, chekli ayrmali sxema, rekurrent formulalar.*

**Termoplastiklik** — mexanik yuklama va temperatura ta’sirida materialning qaytmas(plastik) deformatsiyalanishini o‘rganuvchi mexanikaning bir sohasi hisoblanadi. Ya’ni materialga kuch ta’sir qilganda temperaturani o‘zgarmas deb hisoblash emas, balki harorat o‘zgartirilganda yoki berilgan kuch natijasida ajralgan issiqlik bilan bog‘liq holda deformatsiyalanish jarayonini o‘rganadi:

- Bir jinsli yoki bir jinsli bo‘lmagan materiallarga kuch berilishi;
- Deformatsiya plastik chegaradan oshishi;
- Kuchli deformatsiya natijasida issiqlik paydo bo‘lishi;
- Natijada temperatura o‘zgarishi bilan metallning mexanik hususiyatlari ham o‘zgarishi yoki aksini ham tasavvur qilishimiz mumkin.

Termoplastiklikda kuchlanish ($\sigma$), plastik deformatsiya ($\varepsilon^p$), va issiqlik (T) birgalikda o‘rganiladi: $\sigma, \varepsilon^p, T$.

Kichik deformatsiyalar uchun deformatsiya tenzori

$$\varepsilon_{ij} = \frac{1}{2}\left(u_{i,j} + u_{j,i}\right) \quad (1)$$

ko‘rinishda hisoblanadi. Umumiy deformatsiya elastik, plastik va temperatura ta’siridagi deformatsiyalardan tashkil topadi:

$$\sigma_{ij} = \lambda\theta\delta_{ij} + 2\mu\varepsilon_{ij} + \alpha\gamma T\delta_{ij} + \frac{\sigma_u}{\varepsilon_u}e_{ij}. \quad (2)$$

Muvozanat tenglamasi

$$\sigma_{ij,j} + X_i = \rho\ddot{u}_i, \quad (3)$$

bilan ifodalanadi.

Temperatura maydonining o‘zgarishi esa issiqlik tenglamasi orqali aniqlanadi:

$$\lambda_0 T_{,ii} - C_\varepsilon \dot{T} - \alpha\gamma T_0 \cdot \dot{\varepsilon}_{ij} = 0. \quad (4)$$

Plastik deformatsiyaning yuzaga kelishi materialdagi kuchlanishning oqish chegarasiga yetishi bilan bog‘liq bo‘lib, umumiy holda

$$F(\sigma_{ij}, \varepsilon_{ij}^p, T) \le 0, \quad (5)$$

shart orqali ifodalanadi.

Boshlang‘ich shartlar:

$$u_i|_{t=t_0} = \varphi_i,\ \dot{u}_i|_{t=t_0} = \psi_i,\ T|_{t=t_0} = T_0, \quad (6)$$

chegaraviy shartlar

$$u_i|_{\Sigma_1} = u_i^0,\ \ T|_{\Sigma_1} = \bar{T}_0,\ \ \sigma_{ij}n_j\big|_{\Sigma_2} = S_i^0, \quad (7)$$

Yuqoridagi (1-7) munosabatlarni birlashtirilib, termoplastiklik jarayonining matematik modeli umumiy bog‘liq tenglamalar sistemasi ko‘rinishida yoziladi va bu sistema mexanik muvozanat, deformatsiya, elastik-plastik xususiyatlar, temperatura ta’siri va issiqlik almashinuvini birgalikda ifodalaydi. Mazkur matematik model keyingi bosqichda sonli usul yordamida yechilib, temperatura va deformatsiya maydonlarining o‘zgarishi aniqlanadi.

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