I-61　連立微分方程式に対する固有マトリクス法

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1. 静力学2次元弾性体系の変位方程式

$$\begin{bmatrix} 2\frac{\partial^2}{\partial x^2}+(1-\nu)\frac{\partial^2}{\partial y^2}, & (1+\nu)\frac{\partial^2}{\partial x\partial y} \\ (1+\nu)\frac{\partial^2}{\partial x\partial y}, & (1-\nu)\frac{\partial^2}{\partial x^2}+2\frac{\partial^2}{\partial y^2} \end{bmatrix}\begin{bmatrix} u \\ v \end{bmatrix}=0,$$

2. 動力学2次元弾性体系の変位方程式

$$\begin{bmatrix} \mu\nabla^2+(\lambda'+\mu)\frac{\partial^2}{\partial x^2}-\rho\frac{\partial^2}{\partial t^2}, & (\lambda'+\mu)\frac{\partial^2}{\partial x\partial y} \\ (\lambda'+\mu)\frac{\partial^2}{\partial x\partial y}, & \mu\nabla^2+(\lambda'+\mu)\frac{\partial^2}{\partial y^2}-\rho\frac{\partial^2}{\partial t^2} \end{bmatrix}\begin{bmatrix} u \\ v \end{bmatrix}=0,$$

3. 静力学3次元弾性体系の変位方程式

$$\begin{bmatrix} (1-2\nu)\nabla^2+\frac{\partial^2}{\partial x^2}, & \frac{\partial^2}{\partial x\partial y}, & \frac{\partial^2}{\partial x\partial z} \\ \frac{\partial^2}{\partial x\partial y}, & (1-2\nu)\nabla^2+\frac{\partial^2}{\partial y^2}, & \frac{\partial^2}{\partial y\partial z} \\ \frac{\partial^2}{\partial x\partial z}, & \frac{\partial^2}{\partial y\partial z}, & (1-2\nu)\nabla^2+\frac{\partial^2}{\partial z^2} \end{bmatrix}\begin{bmatrix} u \\ v \\ w \end{bmatrix}=0,$$

4. 動力学3次元弾性体系の変位方程式

$$\begin{bmatrix} (1-2\nu)\Box_2+\frac{\partial^2}{\partial x^2}, & \frac{\partial^2}{\partial x\partial y}, & \frac{\partial^2}{\partial x\partial z} \\ \frac{\partial^2}{\partial x\partial y}, & (1-2\nu)\Box_2+\frac{\partial^2}{\partial y^2}, & \frac{\partial^2}{\partial y\partial z} \\ \frac{\partial^2}{\partial x\partial z}, & \frac{\partial^2}{\partial y\partial z}, & (1-2\nu)\Box_2+\frac{\partial^2}{\partial z^2} \end{bmatrix}\begin{bmatrix} u \\ v \\ w \end{bmatrix}=0,$$

5. 静力学円形アーチの変位方程式

$$\begin{bmatrix} \frac{d^3}{d\varphi^3}+\frac{d}{d\varphi}, & -\frac{d^2}{d\varphi^2}-1 \\ (1+\alpha)\frac{d^2}{d\varphi^2}, & \alpha\frac{d^3}{d\varphi^3}-\frac{d}{d\varphi} \end{bmatrix}\begin{bmatrix} u \\ w \end{bmatrix}=0,$$

6. 動力学円形アーチの変位方程式

$$\begin{bmatrix} \frac{\partial^3}{\partial\varphi^3}+\frac{\partial}{\partial\varphi}-\frac{\gamma R^2}{gE}\frac{\partial^3}{\partial\varphi\partial t^2}, & -\frac{\partial^2}{\partial\varphi^2}-1-\frac{\gamma R^2}{gE}\frac{\partial^2}{\partial t^2} \\ \left(1+\frac{I}{AR^2}\right)\frac{\partial^2}{\partial\varphi^2}-\frac{\gamma R^2}{gE}\frac{\partial^2}{\partial t^2}, & \frac{I}{AR^2}\frac{\partial^3}{\partial\varphi^3}-\frac{\partial}{\partial\varphi}-\frac{\gamma I}{gEA}\frac{\partial^3}{\partial\varphi\partial t^2} \end{bmatrix}\begin{bmatrix} u \\ w \end{bmatrix}=0,$$

7. Hooke 法則による Timoshenko 梁振動の変位方程式

$$\begin{bmatrix} kGA\frac{\partial}{\partial x}, & EI\frac{\partial^2}{\partial x^2}-kGA-\frac{\gamma I}{g}\frac{\partial^2}{\partial t^2} \\ kGA\frac{\partial^2}{\partial x^2}-\frac{\gamma A}{g}\frac{\partial^2}{\partial t^2}, & -kGA\frac{\partial}{\partial x} \end{bmatrix}\begin{bmatrix} w \\ \psi \end{bmatrix}=0,$$

8. Voigt 法則による Timoshenko 梁振動の変位方程式

$$\begin{bmatrix} b\left(1+p'\frac{\partial}{\partial t}\right)\frac{\partial}{\partial\rho}, & \left(1+p\frac{\partial}{\partial t}\right)\frac{\partial^2}{\partial\rho^2}-bL\left(1+p'\frac{\partial}{\partial t}\right)-c\frac{\partial^2}{\partial t^2} \\ \left(1+p'\frac{\partial}{\partial t}\right)\frac{\partial^2}{\partial\rho^2}-a\frac{\partial^2}{\partial t^2}, & -L\left(1+p'\frac{\partial}{\partial t}\right)\frac{\partial}{\partial\rho} \end{bmatrix}\begin{bmatrix} w \\ \psi \end{bmatrix}=0,$$