+ a. p.

1d

$-(k u')' = f$

$-(k u')' + c \cdot u + a u' = f$

2d

$-\operatorname{div}(k \cdot \nabla u) = f$

$+ c \cdot u + a_1 \frac{\partial u}{\partial x} + a_2 \frac{\partial u}{\partial y}$

$-\operatorname{div}(\nabla u(x)) = \lambda u(x)$

(1) (EIG) $\begin{cases} -\Delta u(x) = \lambda u(x) & v\ \Omega \subset \mathbb{R}^2 \\ u(x) = 0 \text{ na } \partial\Omega & \| (0,1)\times(0,1) \end{cases}$

LA: $Ax = \lambda x$ (x, λ) $\quad Ax = \lambda M x$

$A = V D V^T$ $\quad M^{-1}A = V D V^T$

$[V, D] = eig(A)$ $\quad [V, D] = eig(A, M)$

(2) (D) $\begin{cases} -\Delta u(x) + 10 \cdot u(x) = f(x) \\ u(x) = 0 \text{ na } \partial\Omega \end{cases}$

$\uparrow$ (kont.)

(V) $\int \nabla u \nabla v + 10 \cdot \int u(x) \cdot v(x) = \int f(x) v(x)$

$\downarrow \quad \downarrow \quad \downarrow$

$Ax + 10 \cdot Mx = b$ $\quad (A + 10 \cdot M)x = b$

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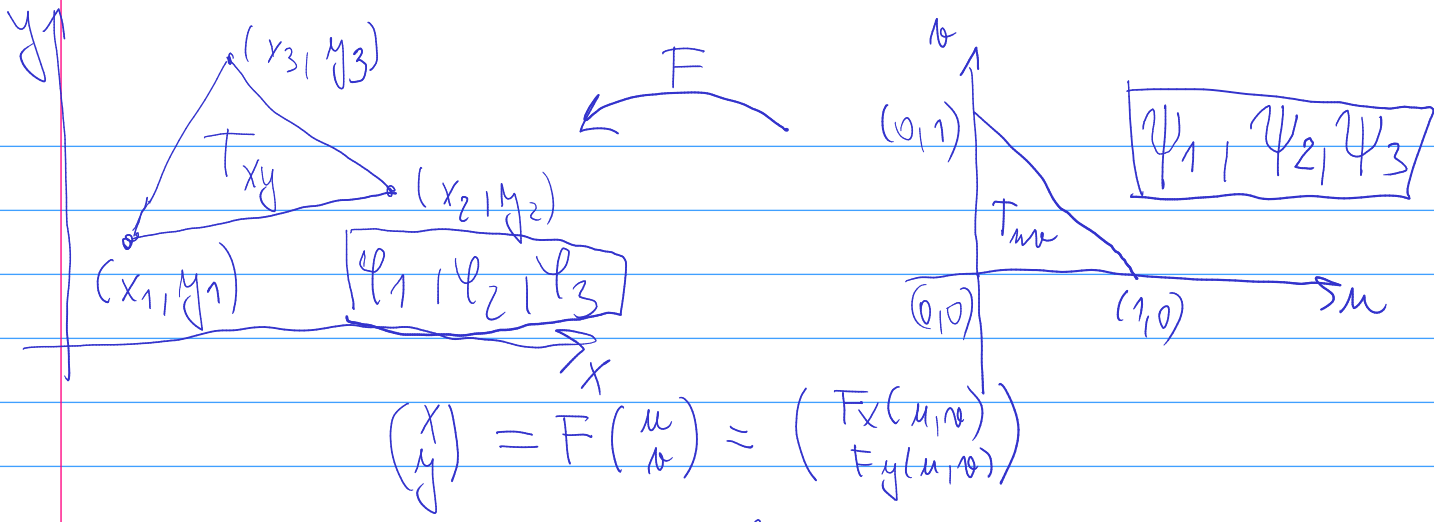
(1) (D) $-\Delta u(x) = \lambda u(x)$

(V) $\int \nabla u(x) \nabla v(x) = \lambda \int u(x) v(x)$

$\downarrow \quad \downarrow$

$A \cdot x = \lambda \cdot M \cdot x$ $\quad Ax = \lambda M x$

$eig(A, M)$



$$\begin{pmatrix} x \\ y \end{pmatrix} = F\begin{pmatrix} u \\ v \end{pmatrix} \simeq \begin{pmatrix} F_x(u,v) \\ F_y(u,v) \end{pmatrix}$$

$$\iint_{T_{xy}} \varphi_i(x,y)\,\varphi_j(x,y)\,dx\,dy = \iint_{T_{uv}} \underbrace{\varphi_i(F_x(u,v), F_y(u,v))}_{\varphi_i \circ F = \psi_i} \cdot$$

$$\cdot \underbrace{\varphi_j(F_x(u,v), F_y(u,v))}_{\psi_j} \cdot \underbrace{|J|}_{2\cdot|T|}\,du\,dv =$$

$$= \iint_{T_{uv}} \psi_i(u,v)\,\psi_j(u,v) \cdot 2 \cdot |T|\,du\,dv =$$

$$= \int_0^1 \left(\int_0^{1-u} \psi_i(\,)\,\psi_j(\,)\,dv \right) du \cdot 2 \cdot |T| \rightsquigarrow M_{loc}(T_{uv})$$

$\psi_1 = 1 - u - v$

$\psi_2 = u$

$\psi_3 = v$

$$M_{loc}(T_{xy}) = \frac{1}{24}\begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 1 & 1 & 2 \end{bmatrix} \cdot 2 \cdot |T|$$

$$= \begin{array}{c} \\ \psi_1 \\ \psi_2 \\ \psi_3 \end{array} \begin{array}{c} \begin{array}{ccc} \varphi_1 & \varphi_2 & \varphi_3 \end{array} \\ \begin{bmatrix} \frac{1}{12} & \frac{1}{24} & \frac{1}{24} \\ \frac{1}{24} & \frac{1}{12} & \frac{1}{24} \\ \frac{1}{24} & \frac{1}{24} & \frac{1}{12} \end{bmatrix} \end{array}$$