(S)
$x_i =$
$a+$
ih
$i \in$
$[0, n+$
$1]$
$h =$
$b - an + 1$

$$(S) \begin{cases} -u'' + p(x)u + q(x)u = g(x) x \in [a,b] & \\ u(a) = \alpha & p, q, g \in C^0([a,b]) \\ u(b) = \beta & q \geq 0 em [a,b] \end{cases}$$

u_i
$u(x_i)$
$U =$
$(u_1, ..., u_n)^T$
$u_0 =$
$alpha$
$u_{n+1} =$
β
$u''(x_i)$
$u'(x_i)$
x_i
??
$f(x)$
x_i

$$f(x_i) = \sum_{n=0}^{\infty} f^{(n)}(x_i) n! (x - x_i)^n = f(x_i) + f'(x_i)(x - x_i) 1! + f''(x_i)(x - x_i)^2 2! + ...$$

(1)
u
x_i
??

$$u(x) = u(x_i) + u'(x_i)(x - x_i) + u''(x_i) 2! (x - x_i)^2 + ...$$

(2)
u
x_i
$x =$
x_{i-1}
$x =$
x_{i+1}
??
??

$$u(x_{i-1}) = u(x_i - h) = u(x_i) - hu'(x_i) + h^2 u''(x_i) 2! - h^3 u^{(3)}(x_i) 3! + O(h^4)$$

(3)

$$u(x_{i+1}) = u(x_i + h) = u(x_i) + hu'(x_i) + h^2 u''(x_i) 2! + h^3 u^{(3)}(x_i) 3! + O(h^4)$$

(4)
??
??

$$u(x_{i+1}) - u(x_{i-1)} 2h = u'(x_i) + O(h^2)$$

(5)

$$u(x_{i+1}) - 2u(x_i) + u(x_{i-1)} h^2 = u''(x_i) + O(h^2)$$

(6)
??
??
(S)

$$u(x_{i+1}) - 2u(x_i) + u(x_{i-1)} h^2 + p(x_i) u(x_{i+1}) - u(x_{i-1)} 2h + q(x_i) u(x_i) - g(x_i) = e_i$$

(7)
$i =$
$1, ..., n$
$e_i =$
$O(h^2)$
$p_i =$
$p(x_i)$
$q_i =$
$q(x_i)$
$g_i =$
$g(x_i)$
(S)

$$(S) \begin{cases} -u_{i+1} + 2u_i - u_{i-1} h^2 + p_i u_{i+1} - u_{i-1} 2h + q_i u_i - g_i = 0 \\ u_0 = \alpha \\ u_{n+1} = \beta \end{cases} i = 1, ..., n$$

(S)
n
n
$M_n R$
$u_1, u_2, ..., u_n)^T$
$\in$
R^n
2
$q_1 -$
$1+$
$h2p_1 \ldots\ldots\ldots 0$
$-$