

Find analytical and numerical (tridiagonal matrix method) solutions of one-dimensional heat conductivity equation:

- $$U_t = U_{xx}, \quad 0 < x < 1, \quad t > 0,$$
 1. $U(0,t) = 0, \quad U_x(1,t) = 0, \quad t > 0,$
 $U(x,0) = x(x^2 - 3), \quad 0 \leq x \leq 1$
- $$U_t = U_{xx}, \quad 0 < x < 1, \quad t > 0,$$
 2. $U_x(0,t) = 0, \quad U(1,t) = 0, \quad t > 0,$
 $U(x,0) = 1 - x^3, \quad 0 \leq x \leq 1$
- $$U_t = 3U_{xx}, \quad 0 < x < \pi, \quad t > 0,$$
 3. $U(0,t) = 0, \quad U(\pi,t) = 0, \quad t > 0,$
 $U(x,0) = x \sin(x), \quad 0 \leq x \leq \pi$
- $$U_t = 9U_{xx}, \quad 0 < x < 2, \quad t > 0,$$
 4. $U(0,t) = 0, \quad U(2,t) = 0, \quad t > 0,$
 $U(x,0) = x^2(2 - x), \quad 0 \leq x \leq 2$
- $$U_t = 4U_{xx}, \quad 0 < x < 3, \quad t > 0,$$
 5. $U(0,t) = 0, \quad U(3,t) = 0, \quad t > 0,$
 $U(x,0) = x(9 - x^2), \quad 0 \leq x \leq 3$
- $$U_t = 4U_{xx}, \quad 0 < x < 2, \quad t > 0,$$
 6. $U(0,t) = 0, \quad U(2,t) = 0, \quad t > 0,$

$$U(x,0) = \begin{cases} x, & 0 \leq x \leq 1, \\ 2 - x, & 1 \leq x \leq 2. \end{cases}$$
- $$U_t = 7U_{xx}, \quad 0 < x < 1, \quad t > 0,$$
 7. $U(0,t) = 0, \quad U(1,t) = 0, \quad t > 0,$
 $U(x,0) = x(3x^4 - 10x^2 + 7), \quad 0 \leq x \leq 1$
- $$U_t = 5U_{xx}, \quad 0 < x < 1, \quad t > 0,$$
 8. $U(0,t) = 0, \quad U(1,t) = 0, \quad t > 0,$
 $U(x,0) = x(x^3 - 2x^2 + 1), \quad 0 \leq x \leq 1$
- $$U_t = 2U_{xx}, \quad 0 < x < 1, \quad t > 0,$$
 9. $U(0,t) = 0, \quad U(1,t) = 0, \quad t > 0,$
 $U(x,0) = x(3x^4 - 5x^3 + 2), \quad 0 \leq x \leq 1$

$$U_t = U_{xx}, \quad 0 < x < 1, \quad t > 0,$$

10. $U(0,t) = 0, \quad U(1,t) = 0, \quad t > 0,$
 $U(x,0) = x(1-x), \quad 0 \leq x \leq 1$

$$U_t = 3U_{xx}, \quad 0 < x < 1, \quad t > 0,$$

11. $U_x(0,t) = 0, \quad U(1,t) = 0, \quad t > 0,$
 $U(x,0) = 1-x, \quad 0 \leq x \leq 1$

$$U_t = U_{xx}, \quad 0 < x < 1, \quad t > 0,$$

12. $U(0,t) = 0, \quad U_x(1,t) = 0, \quad t > 0,$
 $U(x,0) = (x-1)^3 + 1, \quad 0 \leq x \leq 1$

$$U_t = 9U_{xx}, \quad 0 < x < 4, \quad t > 0,$$

13. $U_x(0,t) = 0, \quad U(4,t) = 0, \quad t > 0,$
 $U(x,0) = x^2, \quad 0 \leq x \leq 4$

$$U_t = 9U_{xx}, \quad 0 < x < 4, \quad t > 0,$$

14. $U(0,t) = 0, \quad U(4,t) = 0, \quad t > 0,$
 $U(x,0) = 1, \quad 0 \leq x \leq 4$

$$U_t = 16U_{xx}, \quad 0 < x < 2\pi, \quad t > 0,$$

15. $U_x(0,t) = 0, \quad U(2\pi,t) = 0, \quad t > 0,$
 $U(x,0) = 4, \quad 0 \leq x \leq \pi$

$$U_t = 3U_{xx}, \quad 0 < x < \pi, \quad t > 0,$$

16. $U_x(0,t) = 0, \quad U(\pi,t) = 0, \quad t > 0,$
 $U(x,0) = x^2(\pi-x), \quad 0 \leq x \leq \pi$

$$U_t = U_{xx}, \quad 0 < x < 1, \quad t > 0,$$

17. $U(0,t) = 0, \quad U_x(1,t) = 0, \quad t > 0,$
 $U(x,0) = x(x^3 - 2x^2 + 2), \quad 0 \leq x \leq 1$

$$U_t = U_{xx}, \quad 0 < x < 1, \quad t > 0,$$

18. $U(0,t) = 0, \quad U_x(1,t) = 0, \quad t > 0,$
 $U(x,0) = \sin(\pi x), \quad 0 \leq x \leq 1$

$$U_t = 3U_{xx}, \quad 0 < x < \pi, \quad t > 0,$$

19. $U(0,t) = 0, \quad U_x(\pi,t) = 0, \quad t > 0,$
 $U(x,0) = x(\pi-x), \quad 0 \leq x \leq \pi$

$$U_t = 5U_{xx}, \quad 0 < x < 2, \quad t > 0,$$

$$20. U(0, t) = 0, \quad U_x(2, t) = 0, \quad t > 0,$$

$$U(x, 0) = x(4 - x), \quad 0 \leq x \leq 2$$

$$U_t = U_{xx}, \quad 0 < x < 1, \quad t > 0,$$

$$21. U(0, t) = 0, \quad U_x(1, t) = 0, \quad t > 0,$$

$$U(x, 0) = x^2(3 - 2x), \quad 0 \leq x \leq 1$$

$$U_t = U_{xx}, \quad 0 < x < 1, \quad t > 0,$$

$$22. U(0, t) = 0, \quad U_x(1, t) = 0, \quad t > 0,$$

$$U(x, 0) = x^3(3x - 4), \quad 0 \leq x \leq 1$$

Draw graphs for analytical and numerical solutions together, find the maximum difference between these two solutions in the given interval.