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תרגיל מס' 2

מצא את הפתרון הכללי של המשוואה הדיפרנציאלית הבאה: (1) $y'' - 4y' + 13y = x + e^x$.

(א) משוואה הומוג'נית: $y'' - 4y' + 13y = 0$ (2)

$r = 2 \pm 3i$

משוואה אופ'נית $r^2 - 4r + 13 = 0$ ← הפתרונות:

הפתרון הכללי ה (2):

$y = A_1 e^{2x} \cos 3x + A_2 e^{2x} \sin 3x ; A_1, A_2 \in \mathbb{R}$

(2) נחפש פתרון פרטי של המשוואה הלא הומוג'נית (1):

(10) ט"ס ר השוואה מודיע:

נפש את הפתרון הפרטי ה-3 בצורה: $y_p = ax + b + ce^x$

$y_p' = a + ce^x$

$y_p'' = ce^x$

$\forall x \in \mathbb{R}$ $ce^x - 4a - 4ce^x + 13ax + 13b + 13ce^x = x + e^x$ (1) →

$10ce^x + 13ax - 4a + 13b = x + e^x$

$$\begin{cases} 13a = 1 \\ -4a + 13b = 0 \\ 10c = 1 \end{cases} \Rightarrow \begin{cases} a = \frac{1}{13} \\ b = \frac{4}{169} \\ c = \frac{1}{10} \end{cases}$$

$y_p = \frac{1}{13}x + \frac{4}{169} + \frac{1}{10}e^x$

הפתרון הכללי ה (1) הוא:

$y_c = A_1 e^{2x} \cos 3x + A_2 e^{2x} \sin 3x + \frac{1}{13}x + \frac{4}{169} + \frac{1}{10}e^x ; A_1, A_2 \in \mathbb{R}$

(ב) ט"ס ר השוואה מודיע:

נפש את הפתרון הפרטי ה-3 בצורה: $y = u \cdot e^{2x} \cos 3x + v \cdot e^{2x} \sin 3x$

$y_p' = u' \cdot e^{2x} \cos 3x + 2ue^{2x} \cos 3x - 3ue^{2x} \sin 3x$ ט"ס

$+ v' \cdot e^{2x} \sin 3x + 2v \cdot e^{2x} \sin 3x + 3v \cdot e^{2x} \cos 3x$

י.ב'. בקוד אורך החישוב, ט"ס מומלץ ש- $ce^x = ce^{2x}$

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