EEE5062计算方法 作业四

习题P95：16

作业提交DDL：2022/3/29 23:59前

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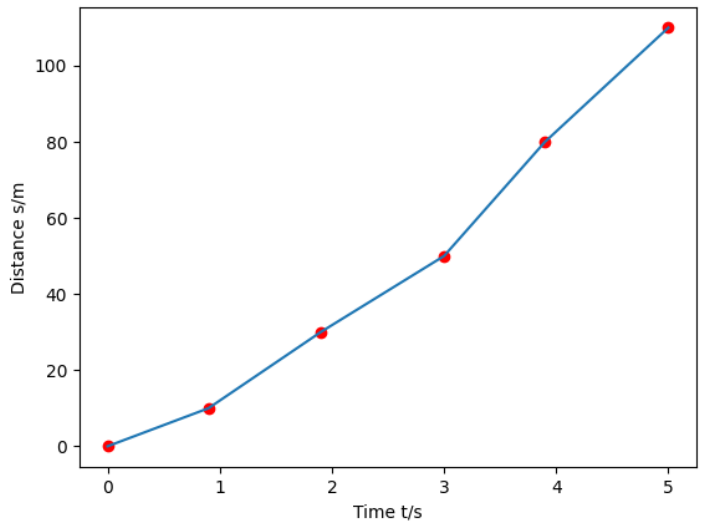
Q16

16. 观测物体的直线运动，得出以下数据：

时间 t/s	0	0.9	1.9	3.0	3.9	5.0
距离 s/m	0	10	30	50	80	110

求运动方程.

解：根据绘图结果，t与s近似服从线性分布，故设 $s = a + bt, \Phi = \{1, t\}$



故

$$(\varphi_0, \varphi_0) = \sum_{j=0}^{5} 1^2 = 6, (\varphi_0, \varphi_1) = \sum_{j=0}^{5} t_j = 14.7, (\varphi_1, \varphi_0) = (\varphi_0, \varphi_1) = 14.7, (\varphi_1, \varphi_1) = \sum_{j=0}^{5} t_j^2 = 53.63$$

$$(s, \varphi_0) = \sum_{j=0}^{5} s_j = 280,\ (s, \varphi_1) = \sum_{j=0}^{5} s_j t_j = 1078$$

得法方程组 $\begin{bmatrix} (\varphi_0, \varphi_0) & (\varphi_0, \varphi_1) \\ (\varphi_1, \varphi_0) & (\varphi_1, \varphi_1) \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} (s, \varphi_0) \\ (s, \varphi_1) \end{bmatrix} \rightarrow \begin{bmatrix} 6 & 14.7 \\ 14.7 & 53.63 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 280 \\ 1078 \end{bmatrix}$

解得：$a \approx -7.8550,\ b \approx 22.2538$，故运动方程为$s = 22.2538t - 7.8550$