

The Fundamentals of Fabrication and Analytical Evaluation of a Sea Wave Impact Tester

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Abstract

The registration of data obtained from the sea wave characteristics has a crucial role in design, fabrication, and maintenance of offshore structures. Therefore, the fabrication of devices which aid the analysis in this respect is of prime interest. In this article, the basics of such a device (a sea wave impact tester) which was built in the University of Guilan is investigated. Several experiments has been carried out during years 1374-1379 in three base stations, namely, Nosrat-Abad (near to Astara), Anzali port, and Ramsar. The results analytically evaluated showed, the system in capable of recording the wave behavior in different situations. The analyzed results showed that the total behavior of sea wave in the south region of the Caspian Sea is independent of location. Also the results showed uniformity between the minimum and maximum sea wave force in the aforementioned areas. Finally a mathematical sea wave impact function model for the south of the Caspian Sea is presented.

Key words: Sea wave impact tester, Design and fabrication, Numerical analysis, Experimental research, Data transmission.

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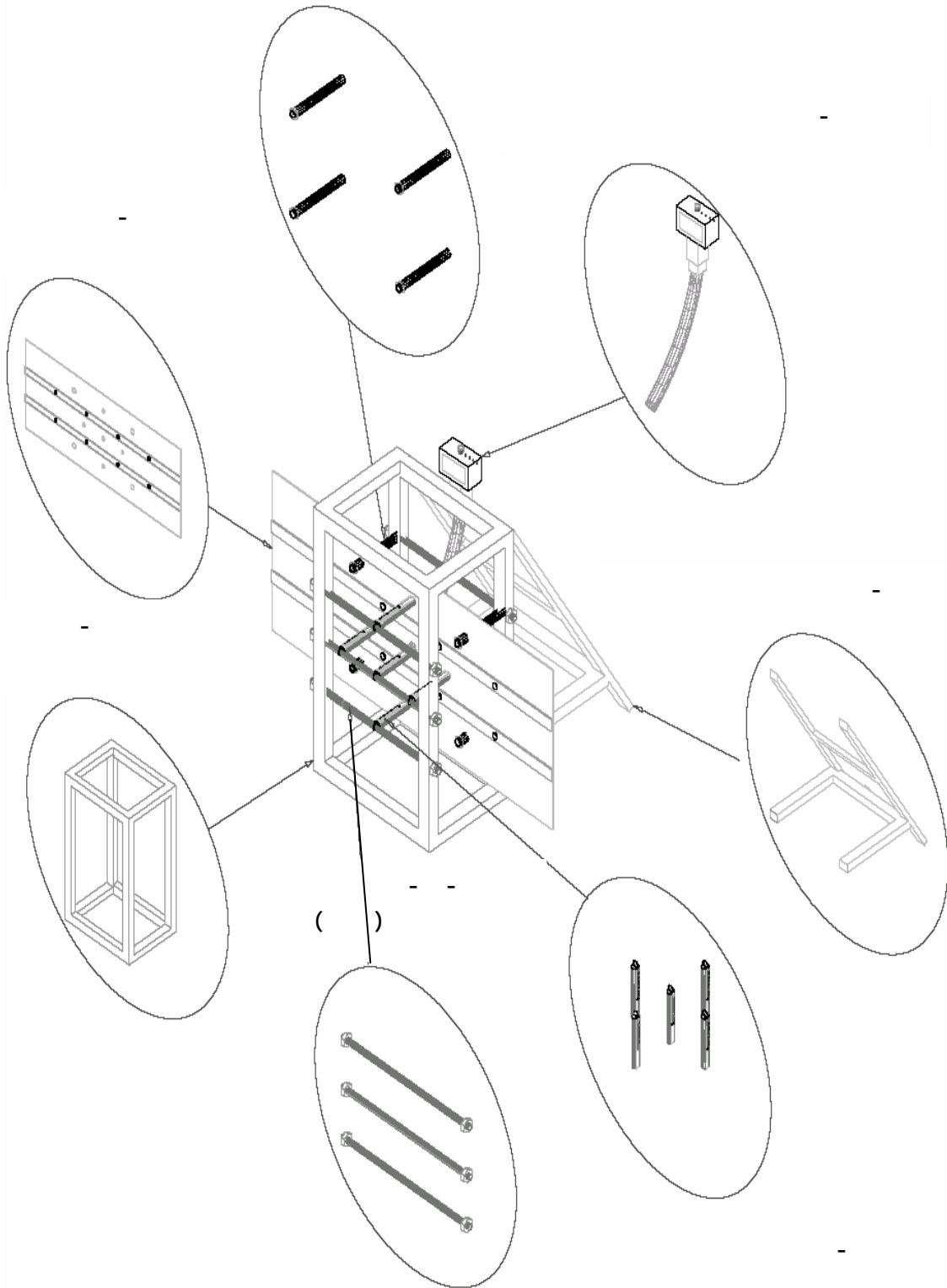
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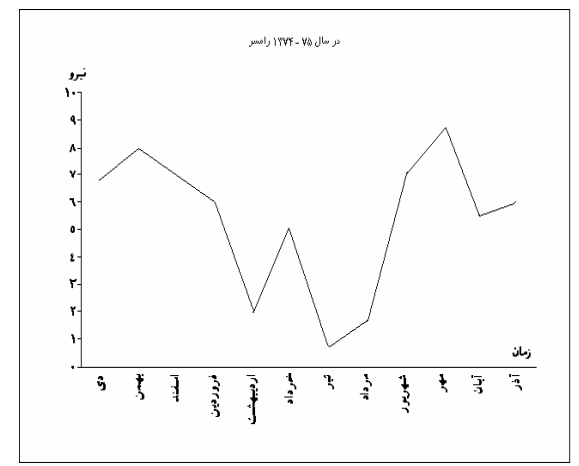
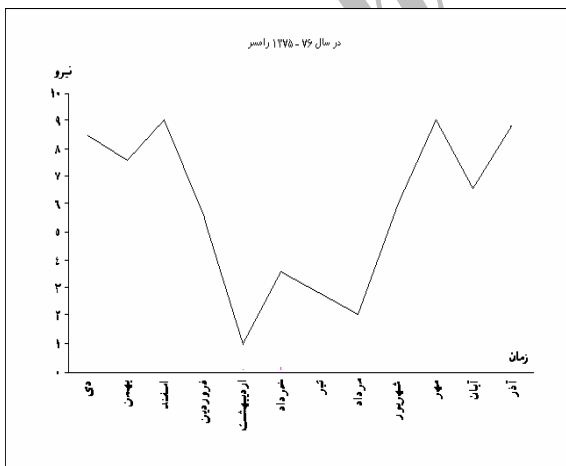
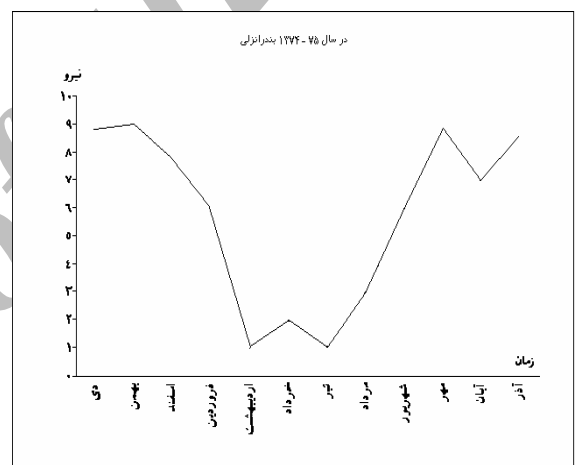
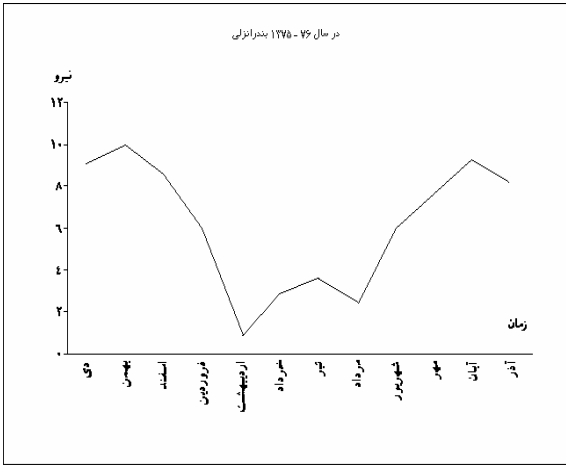
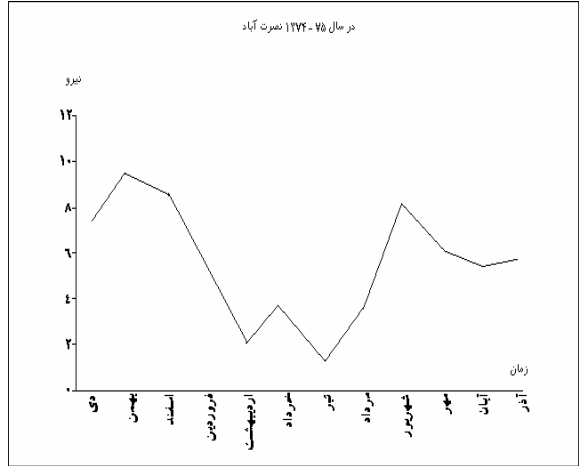
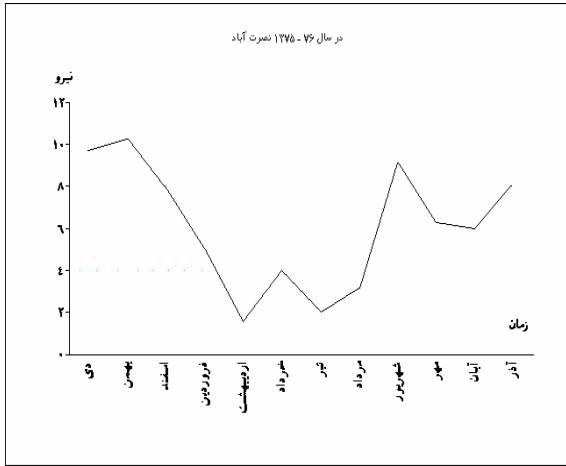
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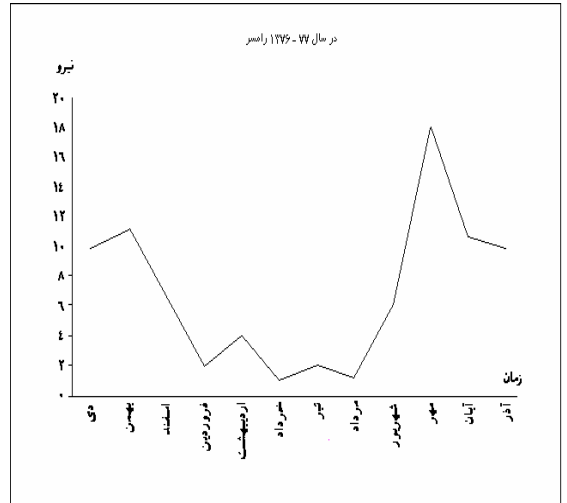
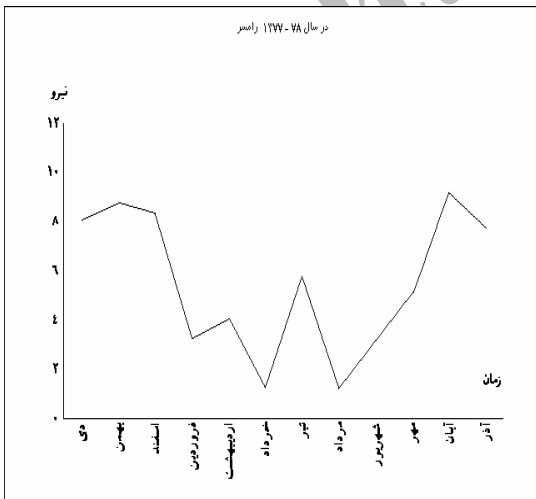
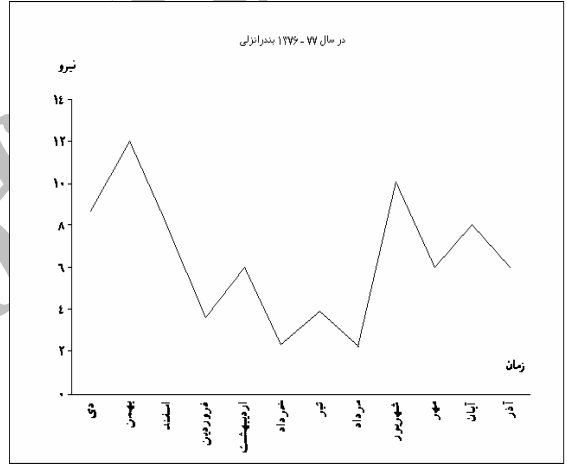
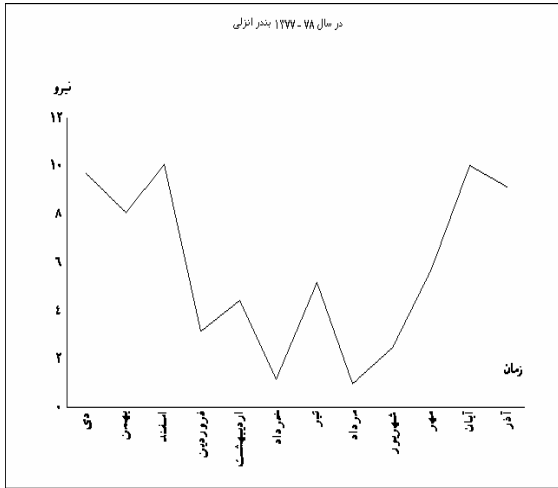
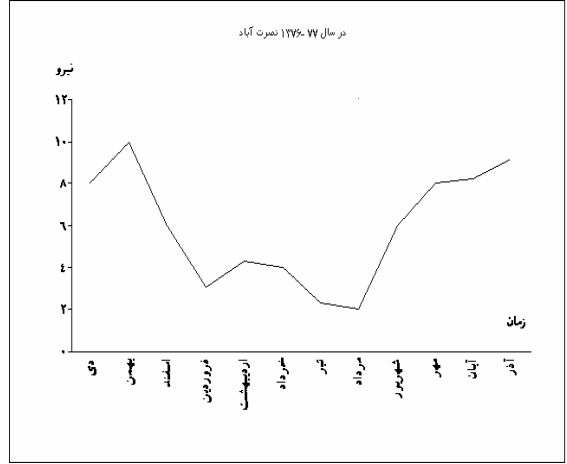
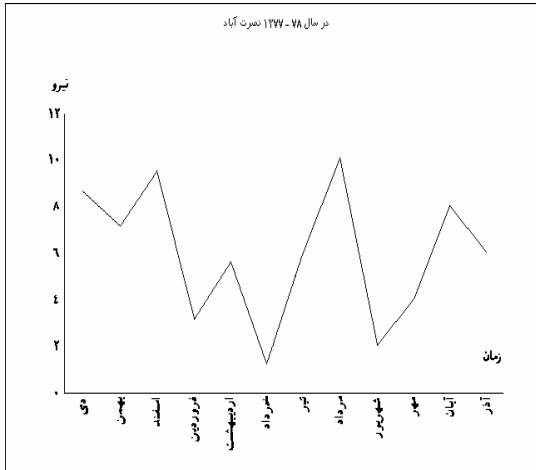
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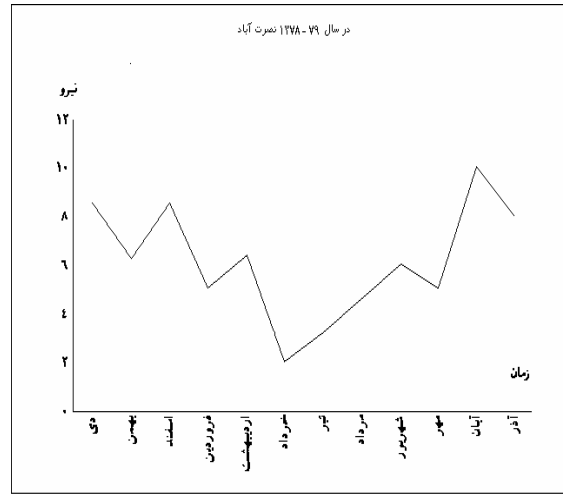
$$f_{3,1}(t) \quad f_{2,1}(t) \quad f_{1,1}(t)$$

place 1

$$f_{1,1}(t)$$

$$: 0 \leq t \leq 12$$

$$f_{1,1} = \begin{cases} 4.67 + 2.74t - 0.580(t-1.)^3 & t < 2. \\ 7.57 + 0.997t - 1.74(t-2.)^2 + 0.0143(t-2.)^3 & t < 3. \\ 16.2 - 2.44t - 1.70(t-3.)^2 + 0.441(t-3.)^3 & t < 4. \\ 23.2 - 4.51t - 0.374(t-4.)^2 + 1.70(t-4.)^3 & t < 5. \\ 2.68 - 0.143t + 4.74(t-5.)^2 - 3.25(t-5.)^3 & t < 6. \\ 5.85 - 0.423t - 5.02(t-6.)^2 + 3.01(t-6.)^3 & t < 7. \\ 10.9 - 1.43t + 4.01(t-7.)^2 - 0.388(t-7.)^3 & t < 8. \\ -40.3 + 5.42t + 2.84(t-8.)^2 - 3.15(t-8.)^3 & t < 9. \\ -6.74 + 1.66t - 6.60(t-9.)^2 + 3.09(t-9.)^3 & t < 10. \\ 29.2 - 2.29t + 2.66(t-10.)^2 - 0.906(t-10.)^3 & t < 11. \\ 2.44 + 0.304t - 0.0629(t-11.)^2 + 0.0210(t-11.)^3 & otherwise \end{cases}$$

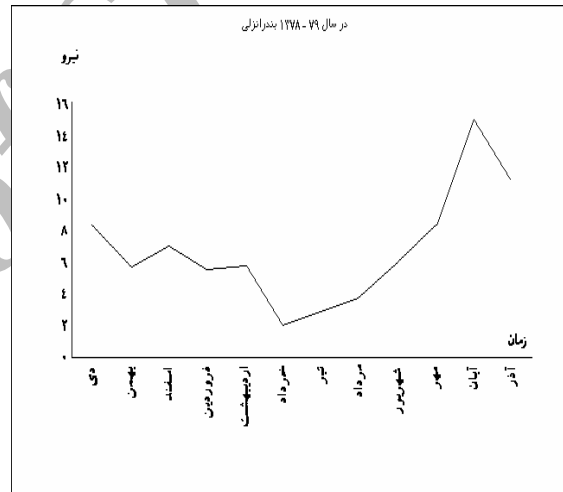


place 2

$$f_{2,1}(t)$$

$$: 0 \leq t \leq 12$$

$$f_{2,1} = \begin{cases} 8.23 + 0.582t - 0.434(t-1.)^3 & t < 2. \\ 10.4 - 0.721t - 1.30(t-2.)^2 + 0.688(t-2.)^3 & t < 3. \\ 11.4 - 1.26t + 0.761(t-3.)^2 - 1.47(t-3.)^3 & t < 4. \\ 22.3 - 4.15t - 3.65(t-4.)^2 + 3.26(t-4.)^3 & t < 5. \\ 9.46 - 1.67t + 6.14(t-5.)^2 - 3.42(t-5.)^3 & t < 6. \\ 0.0508 + 0.353t - 4.11(t-6.)^2 + 2.52(t-6.)^3 & t < 7. \\ 3.18 - 0.323t + 3.44(t-7.)^2 - 1.16(t-7.)^3 & t < 8. \\ -21.8 + 3.09t - 0.0296(t-8.)^2 + 0.152(t-8.)^3 & t < 9. \\ -25.3 + 3.48t + 0.426(t-9.)^2 - 1.50(t-9.)^3 & t < 10. \\ 10.3 - 0.177t - 4.09(t-10.)^2 + 2.51(t-10.)^3 & t < 11. \\ 15.8 - 0.824t + 3.44(t-11.)^2 - 1.15(t-11.)^3 & otherwise \end{cases}$$

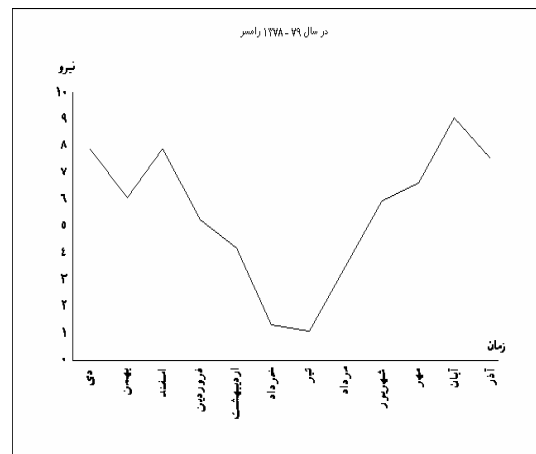


place 3

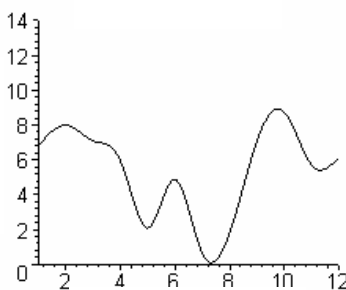
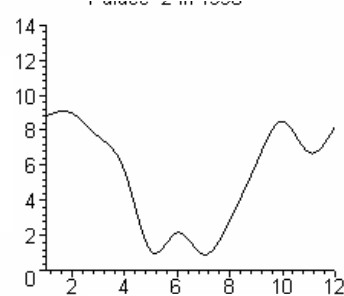
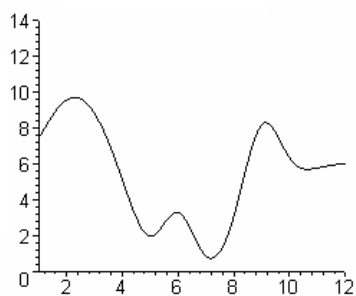
$$f_{3,1}(t)$$

$$: 0 \leq t \leq 12$$

$$f_{3,1} = \begin{cases} 5.03 + 1.80t - 0.637(t-1.)^3 & t < 2. \\ 8.21 - 0.108t - 1.91(t-2.)^2 + 1.11(t-2.)^3 & t < 3. \\ 8.90 - 0.606t + 1.41(t-3.)^2 - 1.96(t-3.)^3 & t < 4. \\ 20.5 - 3.65t - 4.45(t-4.)^2 + 4.25(t-4.)^3 & t < 5. \\ 1.13 + 0.192t + 8.29(t-5.)^2 - 5.69(t-5.)^3 & t < 6. \\ 6.64 - 0.293t - 8.78(t-6.)^2 + 4.82(t-6.)^3 & t < 7. \\ 24.3 - 3.38t + 5.69(t-7.)^2 - 1.14(t-7.)^3 & t < 8. \\ -34.7 + 4.56t + 2.26(t-8.)^2 - 1.53(t-8.)^3 & t < 9. \\ -33.3 + 4.49t - 2.33(t-9.)^2 - 0.496(t-9.)^3 & t < 10. \\ 25.4 - 1.66t - 3.82(t-10.)^2 + 2.45(t-10.)^3 & t < 11. \\ 27.1 - 1.94t + 3.54(t-11.)^2 - 1.18(t-11.)^3 & otherwise \end{cases}$$



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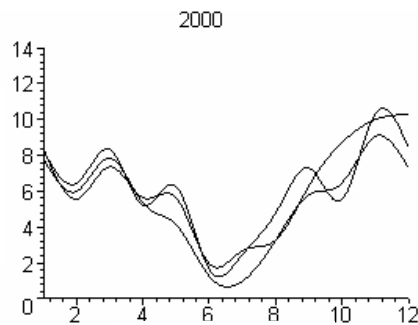
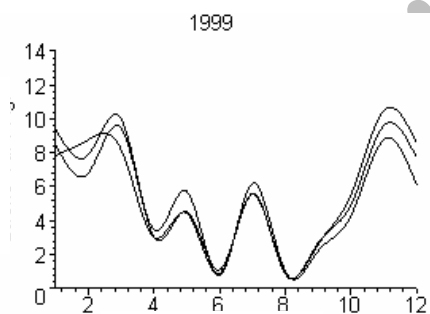
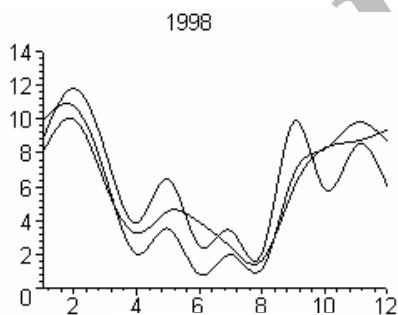
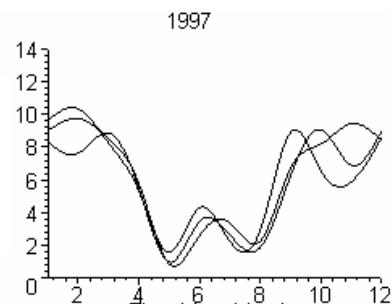
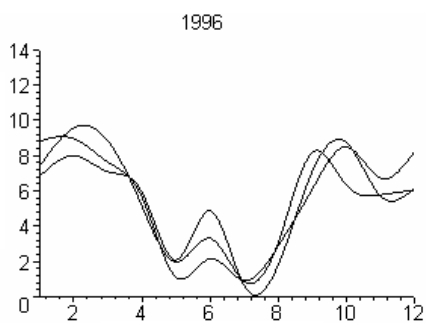
$$0 \leq t \leq 12$$

$$f_{3,1}(t) \quad f_{2,1}(t) \quad f_{1,1}(t)$$

$$g_5 \quad g_4 \quad g_3 \quad g_2 \quad g_1$$

$$f_{i,k}(t) \quad i=1,2,3, \quad k=1,2,\dots,5$$

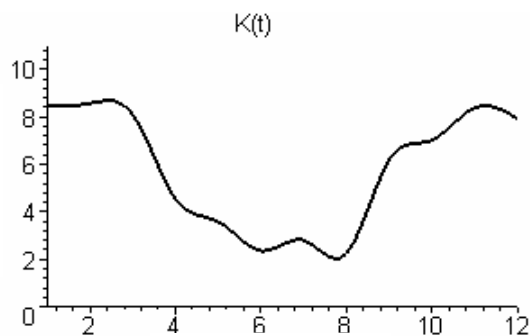
$$K(t)$$



Place 3 Place1

() K(t)

$$K(t) := \begin{cases} 8.48 - 0.0230t + 0.125(t-1.)^3 & t < 2. \\ 7.85 + 0.351t + 0.374(t-2.)^2 - 1.19(t-2.)^3 & t < 3. \\ 15.5 - 2.46t - 3.19(t-3.)^2 + 2.11(t-3.)^3 & t < 4. \\ 14.6 - 2.52t + 3.13(t-4.)^2 - 1.56(t-4.)^3 & t < 5. \\ 8.33 - 0.949t - 1.55(t-5.)^2 + 1.28(t-5.)^3 & t < 6. \\ 3.72 - 0.225t + 2.28(t-6.)^2 - 1.61(t-6.)^3 & t < 7. \\ 6.43 - 0.519t - 2.57(t-7.)^2 + 2.53(t-7.)^3 & t < 8. \\ -13.2 + 1.93t + 5.02(t-8.)^2 - 3.02(t-8.)^3 & t < 9. \\ -20.0 + 2.91t - 4.03(t-9.)^2 + 1.96(t-9.)^3 & t < 10. \\ -0.312 + 0.732t + 1.86(t-10.)^2 - 1.22(t-10.)^3 & t < 11. \\ -0.150 + 0.775t - 1.81(t-11.)^2 + 0.604(t-11.)^3 & \text{otherwise} \end{cases}$$



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