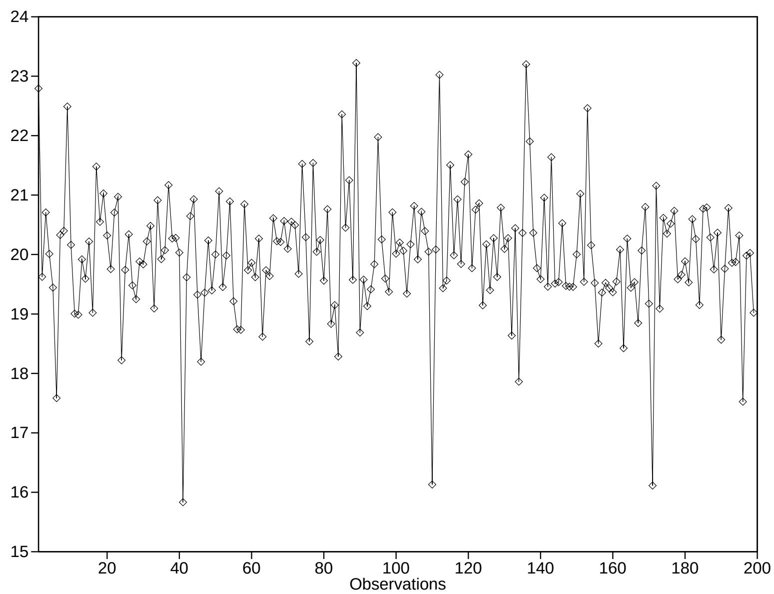
4. An Example

The training data set plotted in Fig. 2(a) is composed of $m = 40$ subgroups of $n = 5$ observations, corresponding to an "in control" process. We have estimated $\hat{m}_1 = 19.99$, $\hat{\mu}_2 = 1.11$, $\hat{\gamma}_1 = -0.27$, and $\hat{\gamma}_2 = 2.96$. If we use the methodology suggested in the appendix, we have $\hat{\delta}_1 = -1.61$ and $\hat{\delta}_2 = 8.64$. Because $-1.96 < \hat{\delta}_1 < 1.96$ and $\hat{\delta}_2 > 1.645$ with a confidence level $1 - \alpha = 0.95$, we can conclude that the data distribution is significantly symmetrical and leptokurtic. In Fig. 2(b) we plotted the standard deviation for the $m = 40$ subgroups. We notice that the UCL $= 1.89$ of the standard deviation chart, assuming normality for the data, leads three points "out of control". Thus, if the value UCL $= 1.89$ is used for the control of the production, we can expect numerous false "out of control" signals. Because the distribution of the data seems to be symmetrical and leptokurtic we suggest to use a symmetrical Johnson S_U transformation. We plotted in Fig. 2(c) the standard deviation of the data transformed using Eq. (5) with $\hat{b} = 1.617$ and $\hat{d} = 1.39$ (estimated using Eqs. (3) and (4)). Assuming that the transformed data are quasi-normal $N(0, 1)$, we immediately have (for $n = 5$) UCL $= 2.089$. We can notice now that there is no more point "out of control".

5. How Kurtosis Affects Classical Charts

The goal of this section is to investigate when the method proposed in this paper can favorably be used and when it cannot, and to give a very general rule concerning



(a)

Fig. 2. An example.