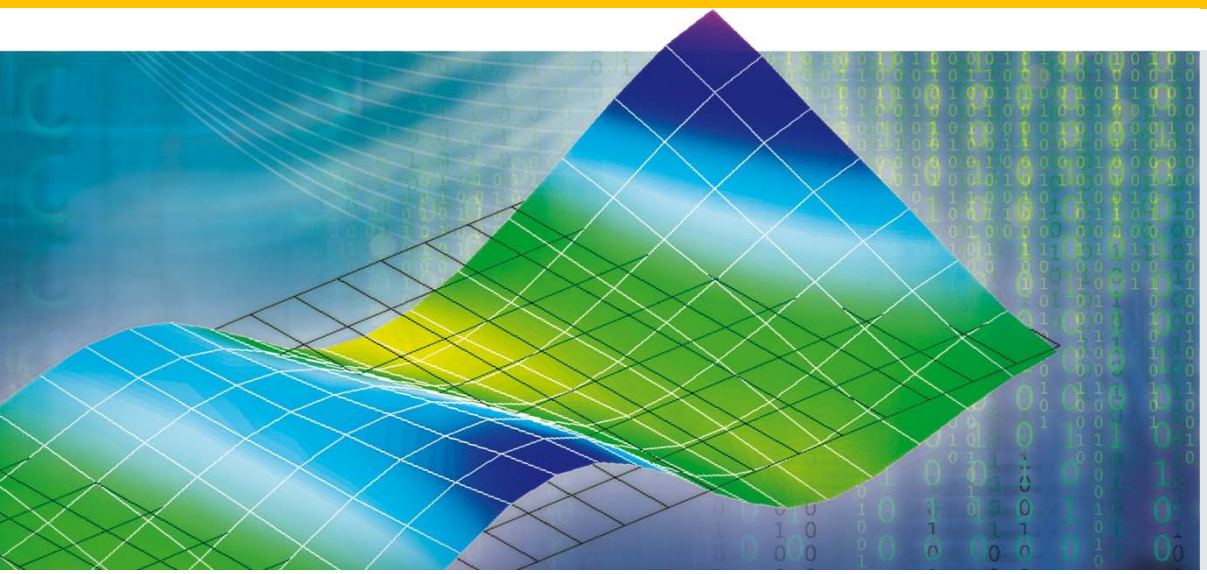
Polytec

Automation with the Polytec Signal Processor



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Introduction

By using the Polytec Signal Processor (SigPro) measurements can be edited subsequently through the VibSoft or Scanning Vibrometer Software. SigPro does not require programming skill and is therefore easier to handle than macros, for example.

Compared to the application of macros there are fewer possibilities. For example, there are no program loops. However, it is possible to automate the signal processor so that the commands do not have to be executed over and over again.

This article uses a concrete example to describe such automation. In this example we will integrate a velocity measurement in the time domain over several measuring points to illustrate the displacement over time. In this case more than 256 points are possible. If the measurement contains more than these 256 points most of the steps have to be repeated. The measurement should contain measuring points with continuous numbers but the numbering of the indices does not have to start with 1.

The functions needed by SigPro are:

- **Integrate** to integrate a time signal
- **Mean** to calculate the average value of a signal
- **Point** to extract one or more measuring points out of a data record
- **PointUnion** to combine the measuring points of different data records

Relative and absolute cell references can be used.

In the first step the measurement data are inserted into SigPro. In our example the file *zeit.SVD* in the folder *SigPro* on drive *D:* is to be used. First of all, display the channel *Vib* and the signal *Velocity* in the domain *Time*. In the processing window click on the measuring object with the right mouse button and chose “copy all points” in the context menu. In SigPro click on cell A1 with the right mouse button and chose “insert” in the context menu. The measuring data is now available in SigPro.

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Simple Method for Integration

Enter the command *=Integrate(A1)* into cell A2. SigPro integrates the time signal of the velocity for all points. Cell A2 now shows the displacement. As an example the point with the index 1 shows a linear slope over time (Fig. 1). This drift is caused by an offset in the velocity signal.

The function *Mean* allows the calculation of the offset. When the offset is subtracted from the velocity signal before integration (Fig. 2) the slope disappears. However, the offset can be different at each measuring point. Additionally the function *Mean* can only be used for data records that contain just a single measuring point. There is no way to repeat the procedure for all measuring points.

A different approach that makes it possible to shorten and simplify some steps is presented below.

"Semi-automation" with the Signal Processor

In a new SigPro document the vibrometer data record *Time/Vib/Velocity* is inserted into cell A1. The measurement in this example contains 209 points with continuous indices from 1 to 209.

A value of *1* is entered into cell C1 and *=C1+1* into cell C2. A value of *2* is displayed as the result. Now copy cell C2, select column C (by clicking on the letter C), press the control key and click on cell C1 (this cell should now be deselected). After using the right mouse button, chose "insert" in the context menu. All cells of column C now contain the formula *=Ci + 1* with i being an integral number (formula view) or a result (formula view not selected) that is continuously numbered from 1 to 256. Column C is now in accordance to the index numbers of the measuring points.

In D1 enter *=Point(a1,c1)*. This means that the point with the index equal to the value of cell C1 is being extracted from the vibrometer data record.

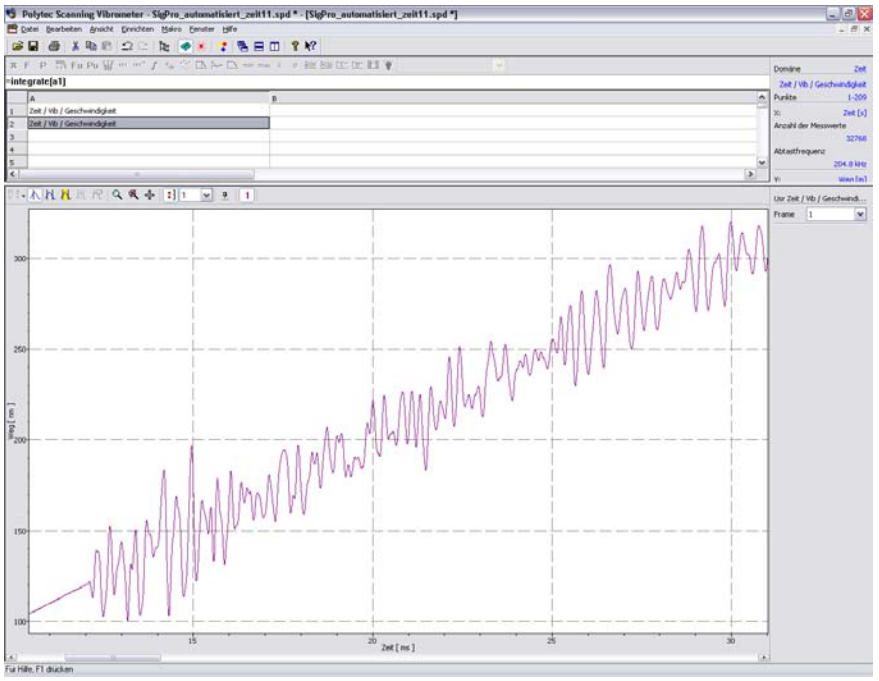

Fig. 1: Zoomed result for a measuring point of the velocity integration without subtraction of the offset.

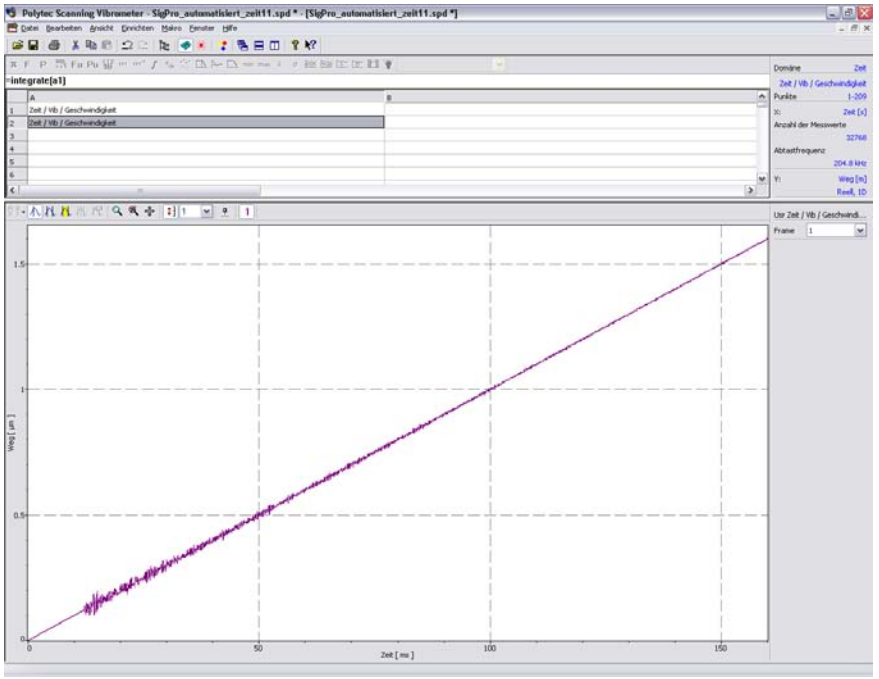

Fig. 2: Result for a measuring point of the velocity integration without subtraction of the offset.

The dollar symbols assure an absolute reference to cell A1.

Copy cell D1, select column D and chose "insert" after clicking on the right mouse button. All cells *Di* now contain the formula *=Point(a1,ci)* and every cell now contains the point with the index i from the vibrometer data record.

In E1 enter *=mean(d1)*. This calculates the offset and accordingly the constant portion of measuring point 1. Now copy the contents of cell E1, select column E and chose "insert" after clicking on the right mouse button. The constant portion of every point is now calculated in the entire column.

In F1 enter *=integrate (D1–E1)*. This subtracts the constant portion from the velocity signal and integrates the result. Now we can see the displacement without the drift. Copy the contents of F1 into the entire column as before. The displacement is now calculated for every measuring point (Fig. 3).

It is possible to skip one or two of these steps by using the formulas *=integrate(D1-mean(D1))* or *=Integrate (Point(a1,c1)-mean(Point(a1,c1)))* to integrate cells D, E and F.

Now we have to combine the points again and insert the result into the SVD file.

In G1 enter *=PointUnion(f1,f2,f3,f4,f5, f6,f7,f8,f9,f10)*. Points 1 to 10 are now combined in one data record in G1. The function *PointUnion* only allows the combination of 10 points. If all 209 points are to be combined, the procedure must be repeated.

Now copy cell G1 and insert it in G11. The result is *=PointUnion(F11,F12,F13,F14, F15,F16,F17,F18,F19,F20)*. Repeat this step (insert) for G21, G31, G41, G51, G61, G71, G81, G91, G101, G111, G121, G131, G141, G151, G161, G171, G181, G191 and G201.

The contents of cell G201 must be changed slightly because the example measurement only contains 209 points.

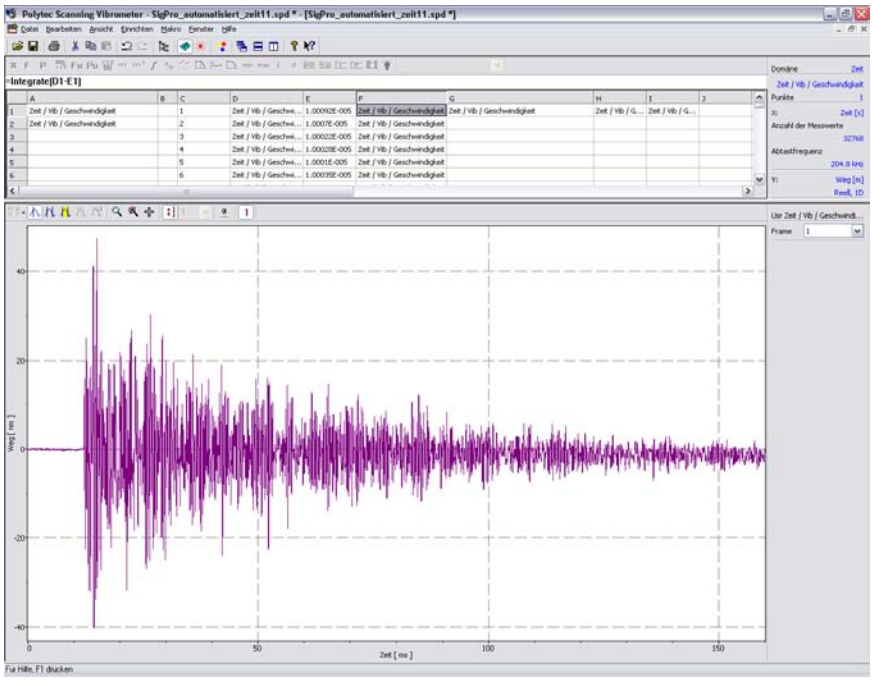

Fig. 3: Result of the velocity integration with subtraction of the offset.

After insertion G201 contains *=PointUnion(F201,F202,F203,F204,F205, F206,F207,F208,F209,F210)*. Delete *F210* so that the cell contains *=PointUnion(F201,F202,F203, F204,F205,F206,F207,F208,F209).* The measuring points are now combined in different cells and in decades.

In H1 enter *=PointUnion(G11,G21, G31,G41,G51,G61,G71,G1)*. Copy cell H1 and insert it into H101. The result is *=PointUnion (G111,G121,G131,G141,G151, G161,G171,G181,G191,G101)*. Therefore points 1 to 100 are combined in H1 and points 101 to 200 in H101. In I1 enter *=PointUnion(G1, G101,G201)* to combine points 1 to 100, 101 to 200 and 201 to 209. All measuring points are now combined in one single data record.

Copy cell I1 and insert the result into the original SVD file. For all measuring points the displacement that is integrated from the velocity signal is inserted. Fig. 5 shows the result (deflection shape) of a time measurement in which the displacement is integrated from the velocity signal. In comparison, Fig. 4 shows the deflection shape in the velocity domain.

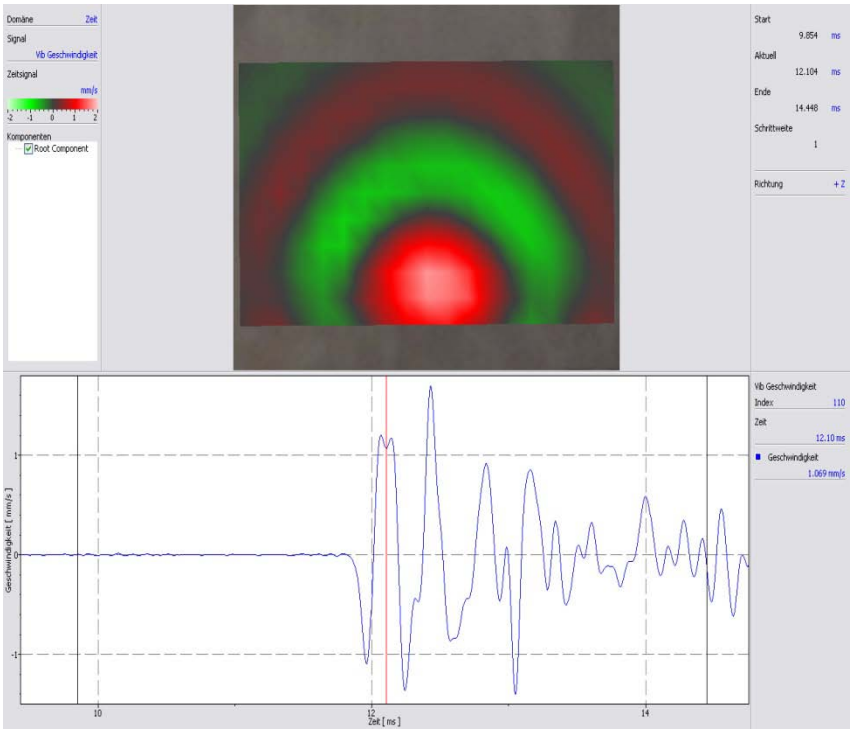

Fig. 4: Wave propagation – velocity signal (measured with a PSV).

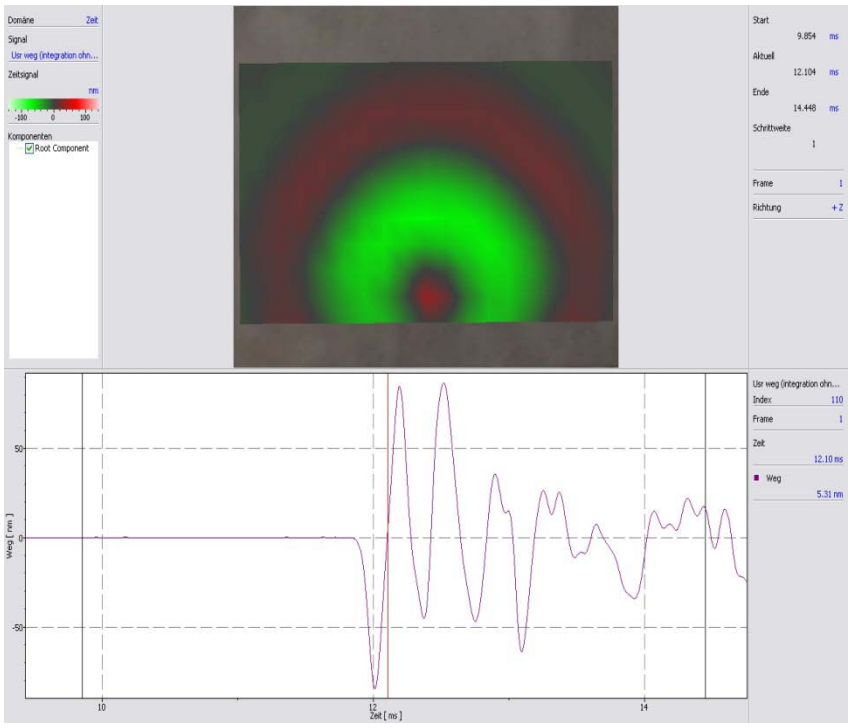

Fig. 5: Wave propagation - displacement signal (integration of the velocity with SigPro).

More Info

You can find more information at **www.polytec.com/applications**, or let our product specialists advise you personally: **info@polytec.com** (North America); **oms@polytec.de** (all other countries).

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