

## USING MACROS TO ANNOTATE GRAPHS BASED ON CHANGING DATA

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### **ABSTRACT**

Eliminating variation in the final product is one goal of a hot steel rolling mill. Normal wear of equipment occurs during the rolling process. Replacing rolling equipment while completing a customer order can introduce variation. This paper discusses one method of monitoring variation that could be introduced as a result of changing rolling equipment.

### **INTRODUCTION**

Hot steel is formed or rolled by forcing it between two cylindrical objects called rolls. The final shape of the product is determined by the shape or contour of the rolls. This shape or contour is commonly referred to as a pass. Typically, there are several passes in each roll. The product created in this discussion is rails. Rails are created from raw material called steel blooms. Blooms are rectangular and have a length sufficient to produce the final product. The bloom is heated between 1500-2000 degrees Fahrenheit and then put in contact with a set of rotating rolls. The rotating rolls pull the bloom slowly through the first pass. Since the steel is very hot, it is soft and allows itself to be shaped. The passes in the first group are called roughing passes and are contained in rolls referred to as the 'roughing set'. As the steel progresses through these passes, the general shape of a rail starts to appear. The final shape of the rail is created by a series of passes contained in rolls referred to as the 'finishing set'.

Normal wear in the passes occurs due to the high forces of rolling and the high temperature of the steel. When it is determined that the amount of wear sustained by a pass is approaching the point that it will negatively affect the dimensions of the final product, the worn 'set' of rolls is changed. This can be the 'roughing set', the 'finishing set', or both.

SAS/GRAPH® and SAS® Macros along with the SAS Annotate Facility are used to visually show the following:

- 1) Dimensional readings for each finished rail sampled and the point which finishing and/or roughing sets are changed.
- 2) Identity of the rolling set(s) changed.

This program will plot a variable, one per rail sample, along the horizontal axis. A vertical line is drawn when the finishing set and/or the roughing set is/are changed. In addition, the identifier for the finishing set is placed near the top of the vertical line and the identifier for the roughing set is placed somewhat lower along that vertical line. This allows for analysis to determine if any variation may have been introduced as a result of changing sets of rolls. Please refer to Figure I for a sample graph. Also, please note that only the first page of the graphics output is included in this discussion.

The following is a little added bonus in the program. The number of data points can often exceed 80. Readability of the graph is enhanced if the number of data points is kept to 80 points per page. Of course, 80 is an arbitrary number, based on the age of the reader. SAS/GRAPH does not currently have an option to allow you to select data points per page. The program discussed in this paper uses the PAGEBY and BYLINE options to cause the program to continue the graph on the next page if the number of data points exceeds 80. These options are discussed on page 88 of the SAS® Technical Report P-222, Changes and Enhancements to Base SAS® Software.

### **CONCLUSION**

As stated earlier, changing rolling equipment while completing a customer order can introduce variation in the final product. This paper discusses one method for monitoring that possible variation.

NOTE: All data are fabricated and are for demonstration purposes only.

99" EXPERT SYSTEM  
VARIABLE  
96123119955  
PAGE 1 OF 3 (1ST PAGE ONLY)

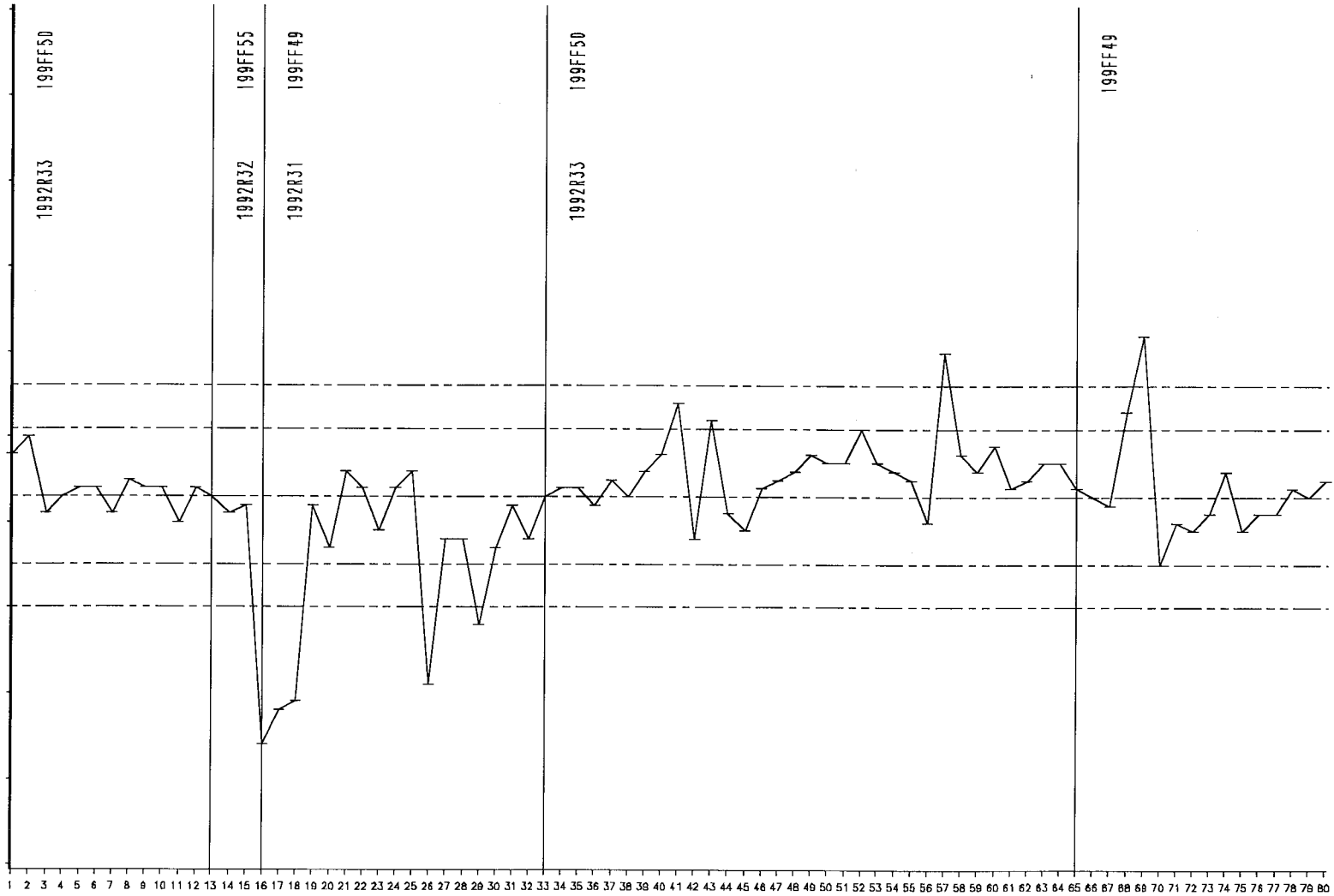


FIGURE 1

## PROGRAM CODE

```
FILENAME ADMDEFS 'GDDM.DEFAULTS'  
DISP=SHR;  
FILENAME ADMIMAGE SYSOUT=X  
COPIES=1 DEST=FLOCAL;
```

```
OPTIONS ERROR = 0 MPRINT  
SYMBOLGEN MLOGIC NOBYLINE;
```

```
LIBNAME BDF 'NTS47.SAS.DATA';
```

```
DATA EXPERT4;  
SET BDF.EXPERT4;  
RUN;
```

```
DATA EXPERT4(DROP=COUNT); RETAIN  
PAGE 0 KOUNT 0;  
SET EXPERT4 END=EOF;  
KOUNT + 1;  
COUNT + 1;  
ROLL_SEQ = PUT(KOUNT,$3.);  
XC = ROLL_SEQ; /** USE TO MERGE  
W/WORK.REFTEXT **/  
IF EOF THEN CALL  
SYMPUT('TOTAL',TRIM(LEFT(PAGE)));  
IF _N_ = 1 THEN PAGE + 1;  
OUTPUT;  
IF COUNT = 80 THEN DO; /*80 PER  
PAGE*/
```

```
        PAGE + 1;  
        COUNT = 0;  
        END;
```

```
RUN;
```

```
PROC SORT DATA=EXPERT4;  
BY FIN ROLL_SEQ;  
RUN;
```

```
DATA FIRSTFIN;  
SET EXPERT4;  
BY FIN ROLL_SEQ;  
/**SOMETIMES THEY SWITCH BACK TO  
A PREVIOUSLY USED SET**/  
IF FIRST.FIN OR (_N_ NE 1 AND  
(ROLL_SEQ-LAG(ROLL_SEQ)GT 1));  
RUN;
```

```
PROC SORT DATA=FIRSTFIN; /** PUT  
BACK IN ROLLED SEQUENCE ORDER **/  
BY ROLL_SEQ;  
RUN;
```

```
DATA FIRSTRGH;  
SET EXPERT4;  
RUN;
```

```
PROC SORT DATA=FIRSTRGH;  
BY ROUGH ROLL_SEQ;  
RUN;
```

```
DATA FIRSTRGH;  
SET FIRSTRGH;  
BY ROUGH ROLL_SEQ;  
/**SOMETIMES THEY SWITCH BACK TO  
A PREVIOUSLY USED SET**/  
IF FIRST.ROUGH OR (_N_ NE 1 AND  
(ROLL_SEQ-LAG(ROLL_SEQ)GT 1));  
RUN;
```

```
PROC SORT DATA=FIRSTRGH; /** PUT  
BACK IN ROLLED SEQUENCE ORDER **/  
BY ROLL_SEQ;  
RUN;
```

```
DATA _NULL_; RETAIN COUNT 0;  
SET FIRSTFIN END=EOF;  
BY ROLL_SEQ;  
COUNT=COUNT+1;  
/**CONTAINS THE LOCATION WHEN  
THE FINISHING SET IS CHANGED **/  
CALL  
SYMPUT('FIN'||LEFT(PUT(COUNT,2.)),  
ROLL_SEQ);
```

```
/**CONTAINS THE FINISHING SET NAME  
**/
```

```
CALL  
SYMPUT('FINSET'||LEFT(PUT(COUNT,2.)),  
FINSET);  
IF EOF THEN DO;  
CALL SYMPUT('MAXFIN',COUNT);  
END;
```

```
RUN;
```

```
DATA _NULL_; RETAIN COUNT 0;  
SET FIRSTRGH END=EOF;  
BY ROLL_SEQ;  
COUNT=COUNT+1;
```

```
/**CONTAINS THE LOCATION WHEN THE  
RGH SET IS CHANGED **/  
CALL  
SYMPUT('RGH'||LEFT(PUT(COUNT,2.)),  
ROLL_SEQ);
```

```

/**CONTAINS THE RGH SET NAME **/
CALL
SYMPUT('RGHSET' || LEFT(PUT(COUNT,2)),
ROUGHSET);

IF EOF THEN DO;
CALL SYMPUT('MAXRGH',COUNT);
END;
RUN;

/** MACROS REFFIN AND REFRGH
CREATE HREF TEXT STRING FOR Gplot
**/
%MACRO REFFIN;
%DO I = 1 %TO &MAXFIN;
"&&FIN&I"
%END;
%MEND;

%MACRO REFRGH;
%DO I = 1 %TO &MAXRGH;
"&&RGH&I"
%END;
%MEND;

%MACRO REFTEXT;
DATA REFTEXT;
FUNCTION = 'LABEL';
/*****
%DO I = 1 %TO &MAXFIN;
XSYS = '2'; YSYS = '1';
XC = "&&FIN&I" ; Y = 90 ;
POSITION = '9'; STYLE = 'SIMULATE';
ANGLE=90; SIZE = 1.9;
TEXT = "&&FINSET&I";
OUTPUT;
%END;

%DO I = 1 %TO &MAXRGH;
XSYS = '2'; YSYS = '1';
XC = "&&RGH&I" ; Y = 75 ;
POSITION = '9'; STYLE = 'SIMULATE';
ANGLE=90; SIZE = 1.9;
TEXT = "&&RGHSET&I";
OUTPUT;
%END;
%MEND;

%REFTEXT
/** GET PAGE ONTO ANNOTATE DATA
SET, REFTEXT **/
DATA PAGE4(KEEP=XC PAGE);
SET EXPERT4;

```

```

RUN;

PROC SORT DATA=PAGE4;
BY XC;
RUN;

PROC SORT DATA=REFTEXT;
BY XC;
RUN;

DATA REFTEXT;
MERGE REFTEXT(IN=A) PAGE4;
BY XC;
IF A;
RUN;

PROC SORT DATA=REFTEXT;
BY PAGE;
RUN;

PROC PRINT DATA=REFTEXT;
TITLE1 'LOCATIONS FOR RGH,FIN ROLL
CHANGES';
RUN;

PROC SORT DATA=EXPERT4;
BY PAGE ROLL_SEQ;
RUN;

PROC PRINT DATA=EXPERT4 NOOBS
HEADING=V;
BY PAGE;
PAGEBY PAGE;
ID ROLL_SEQ;
VAR ROUGHSET FINSET VARIABLE;
TITLE1 '99" EXPERT SYSTEM';
TITLE2 '96123119955';
TITLE3 "PAGE #BYVAL(PAGE) OF
&TOTAL";
RUN;

GOPTIONS GDDMTOKEN=IMG240X
NOTEXT82 NOAUTOFEED
DEVICE=GDDMFAM4
GDDMNICKNAME=B3800 GOPT10
GEPiLOG='04'X
VPOS=100 HPOS=300 GCLASS=5 DISPLAY
NOFASTTEXT
NOCHARACTERS NOCELL;
RUN;

```

```

PROC GPLOT DATA=WORK.EXPERT4;
BY PAGE;
  SYMBOL1 C=RED V=NONE I=HILOTJ;
  AXIS1 LABEL=NONE
  VALUE=NONE
  /** ORDER = (n.nn TO n.nn BY 0.01)**/
  MINOR = NONE;
  AXIS2 LABEL=NONE
VALUE=(F=SIMPLEX H=1.0)
  MAJOR=(NUMBER=150);
  PLOT VARIABLE*ROLL_SEQ / HREF=
%REFFIN %REFRGH ANNO=REFTEXT
  VAXIS=AXIS1 HAXIS=AXIS2
  /*VREF= n.nn n.nnn n.nnn n.nnn*/
  LV=14;
  TITLE1 F=SIMPLEX H=2 '99" EXPERT
SYSTEM';
  TITLE2 F=SIMPLEX H=2 'VARIABLE';
  TITLE3 F=SIMPLEX H=2 '96123119955';
  TITLE4 F=SIMPLEX H=2 "PAGE
#BYVAL(PAGE) OF &TOTAL";
  RUN;
  QUIT;

```

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## REFERENCES

SAS Institute Inc. (1991), SAS Technical Report P-222, Release 6.07, Cary, NC: SAS Institute Inc.

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