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Supporting Information for

[Proper b -value Estimation Method in Rock Acoustic Emission Testing]

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Introduction

This supporting information provides the MATLAB codes of FGS method which proposed in the manuscripts. In addition, the original acoustic emission data of three types of rock samples in static dilation rupturing test are also uploaded as Datasets - ds01 to ds03.

Text S1.

```
function [zuo1,you1,ss]=zuoyou1(LN,X,delta1,num1) % LN, X, delta1 and num1 represent the
log(N), amplitude,  $\sigma$  and  $\mu$  respectively,
nn=size(X);
if nn(1)==1
X=X';
end
nn=size(LN);
if nn(1)==1
LN=LN';
end
ss=[];
dy=diff(LN)./diff(X);% dy is the S(Ai)
dy1=dy(find(dy<0));m=length(dy1);
std0=std(dy);
std1=std(dy1);
zuo1=0;you1=0;
s=0;flag=[];
for i=1:m
temp=length(find(dy1>=dy1(i)-std1*delta1 & dy1<=dy1(i)+std1*delta1));
if s<temp
flag=i;s=temp;
end
end
mu=dy1(flag);% mu is the benchmark slope S(Ai0)
dianshu=max(2,min(ceil(num1*s/std0),100));
len=max(mu-min(dy),max(dy)-mu);
delta=len/dianshu:len/dianshu:len;
temp1=zeros(1,dianshu);
for kk=1:2
for j=1:dianshu
temp1(j)=length(find(dy>=mu-delta(j) & dy<=mu+delta(j)));
end
temp2=diff(temp1);
s=inf;flag1=1;
for k=1:dianshu-1
if k<dianshu-1
D=var(temp2(1:k))*(k-1)+var(temp2(k+1:dianshu-1))*(dianshu-k-2);%Fisher optimum split
method
else
D=var(temp2(1:k))*(k-1);
end
if s>D
s=D;
flag1=k;
end
end
```

```

end
ss=find(dy>=mu-delta(flag1) & dy<0);
if ~isempty(ss)
    if kk==1
        dy2=dy(ss);
        std2=std(dy2);
        ss=find(dy>=mu-1*std2 & dy<0);
    end
    len=length(ss); flag2=0;
    while len>5
        if X(ss(2))-X(ss(1))>0.05
            ss(1)=[];
            len=len-1;
        elseif X(ss(len))-X(ss(len-1))>0.05
            ss(len)=[];
            len=len-1;
        end
        flag2=flag2+1;
        if flag2>3
            break;
        end
    end
    if ~isempty(ss)
        zuo1=min(ss);
        you1=max(ss)+1;
        X2=X(zuo1:you1);LN2=LN(zuo1:you1);
        X20=[ones(length(X2),1),X2];
        bb=regress(LN2,X20);
        mu=bb(2);
    else
        break;
    end
end
end
end

```

Text S2.

```
clc
clear
global LN00 X00 a00 M
M=10000;
fuhao='BI';hangshu=213388;kuadu=10;
if length(fuhao)==1
j=0;
i=abs(fuhao)-65+1;
elseif length(fuhao)==2
j=abs(fuhao(1))-65+1;
i=abs(fuhao(2))-65+1;
end
lieshu=j*26+i;
mm=floor(lieshu/kuadu);
if mod(lieshu,kuadu)==0
mm=mm-1;
end
k=-1;flag=[];flag1=[];flag5=[];
std1=[];
while k<=mm-1
k=k+1;
if k==mm
duandian(1)=mm*kuadu+1;duandian(2)=lieshu;
elseif k~=mm
duandian(1)=k*kuadu+1;duandian(2)=(k+1)*kuadu;
end
j=zeros(1,2);i1=j;
for ii=1:2
j(ii)=floor(duandian(ii)/26);i1(ii)=duandian(ii)-j(ii)*26;
if j(ii)==0 &&ii==2
zifur=char(64+i1(ii));
elseif j(ii)==0 &&ii==1
ziful=char(64+i1(ii));
elseif j(ii)~=0 && ii==2
zifur=strcat(char(64+j(ii)),char(64+i1(ii)));
elseif j(ii)~=0 && ii==1
ziful=strcat(char(64+j(ii)),char(64+i1(ii)));
end
end
zifu1=strcat(ziful,'1',' ');
zifu1=strcat(zifu1,zifur,num2str(hangshu));
ab=xlsread('C:\Users\Administrator\Desktop\sj.xlsx',1,zifu1);
sz=size(ab);
for kk=1:sz(2)
dqlie=k*10+kk;
```

```

if dqlie<=26
zifu3=char(64+dqlie);
elseif floor(dqlie/26)==1
zifu3=strcat('A', char(64+rem(dqlie,26)));
elseif (floor(dqlie/26)==2&&rem(dqlie,26)==0)
zifu3=strcat('A', char(64+26));
elseif floor(dqlie/26)==2
zifu3=strcat('B', char(64+rem(dqlie,26)));
end
a1=ab(:,kk);
a1=a1(~isnan(a1));
[LN,X]=LNX(a1);
X1=[ones(length(X),1),X'];
[bb1,bint1,r1,rint1,stats1]=regress(LN',X1);
X00=X;LN00=LN;a00=a1;
x0=[0.1 10];
lb=[0.001,1];ub=[1 100];
options=optimset('MaxIter',1000);
problem = createOptimProblem('fmincon','objective',@(x)
canshu(x),'x0',x0,'lb',lb,'ub',ub,'options',optimset('Algorithm','SQP','Disp','none'));
gs=GlobalSearch;
[x,std01]=run(gs,problem);
delta1=x(1);num1=x(2);
[zuo1,you1]=zuoyou1(LN',X',delta1,num1);
if zuo1~=0
you10=X(you1)'^20;
zuo10=X(zuo1)'^20;
plot(X,LN,'.b')
hold on
XX=X(zuo1:you1)';LNN=LN(zuo1:you1)';
X1=[ones(length(XX),1),XX];
[bb2,bint2,r2,rint2,stats2]=regress(LNN,X1);
plot(XX,bb2(1)+bb2(2)*XX);
hold on;
plot(XX,LNN)
hold on
pause(5)
hold off;
else
'NO'
end
end
end
flag=[flag [bb1;reshape(bint1',4,1);stats1';bb2;reshape(bint2',4,1);stats2';zuo10;you10]];
end
std1=[std1; [std01 delta1 num1]];
xlswrite('C:\Users\Administrator\Desktop\std1.xlsx',std1);

```

```
xlswrite('C:\Users\Administrator\Desktop\regress.xlsx',flag);
```

Text S3.

```
function zhi=canshu(x)
global LN00 X00 M
X=X00;LN=LN00;
delta1=x(1);num1=x(2);
[zuo1,you1]=zuoyou1(LN00,X00,delta1,num1);
m=length(LN00);
nn=size(X);
if nn(1)==1
X=X';
end
nn=size(LN);
if nn(1)==1
LN=LN';
end
if zuo1~=0
if you1-zuo1<3
zhi=M;
else
X2=X(zuo1:you1);LN2=LN(zuo1:you1);
X20=[ones(length(X2),1),X2];
[~,~,~,stats]=regress(LN2,X20);
zhi=stats(4);
end
else
zhi=M;
end
end
```