

The Relationship Between Voltage and Life in Accelerated Life
 The Relationship Between Voltage and Life in Accelerated Life
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School of applied mathematics, XJTLU University, Suzhou, China **Experiment** International Conference on Social De

and Intelligent Technology (
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School of applied mathematics, XJTLU University, Suzh

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School of applied mathematics, XJTLU University, Suzhou, China

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Abstract: The increasingly developing developed methods like Hisociety
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society has put forward higher Life Testing (HALT) and

requirements for the inspection speed of Stress Screening (HASS)

products. In order to meet the requi **Example 12** and forward higher
 Society has put forward higher
 inverse products. In order to meet the requirements
 inverse product life cancel of Stress Screening (HASS)
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requirements for the inspection speed of
products. In order to meet the requirements
for the increase of product life detection
rate, the accelerated life experiment came
into being. The pur **Keywords:** Accelerated Life; Inverse Power
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Trate, the accelerated life experiment came

study the relationship between voltage and stepping stress t Fract interacts or product interactions and the interactions and the excelerated life experiment came
 Law: the redationship between voltage and

life, using the method of linear regression, should be grounded in

throug **1. Introduction**
 1. Introduction 1. Introduction
 1. Introducti The, using the method of inear regression,

should be ground

semi-parameter to the whole, to analyze all

the data. And because the relationship

based on extens

between voltage and life conforms to the

inverse power la

Regression

Example and Example and Stress Servers (Separated Life; Inverse Power
 Easy is the subject of the series of the series applications of the metallity produce pr Keywords: Accelerated Life; Inverse Power

Law; Semi-parametric Hypothesis; Linear

Regression

Regression

1. Introduction

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with the intensifying global competition, precision of **Exertional Failure Methodisce Continuos**
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greater reliability, while reducing costs an **Regression**
 1. Introduction
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with the intensifying global competition,

manufacturers face immense pressure to
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\text{Wey experimental fact} & & & & & \\$ 1. Introduction

With the intensifying global competition,

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manufacturers face immense pressure to

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With the intensifying global competition,

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produce products that offer more features and

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and produce relativity, while reducing costs and

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annufacturers face immense pressure to Key experimental
greater reliability, while reducing costs and voltage, electrical
greater reliability, while reducing co manutacturers tace immense pressure to

produce products that offer more features and

greater relability, while reduce incomes and

delivery times [1]. Accelerated testing is measures voltage, electrical current

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greater reliability, while reducing costs and

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delivery times [1]. Accelerated testing is

measures voltage per u

gaining traction in the industry f greater reliability, while reducing costs and

delivery times [1]. Accelerated testing is measures voltage per

gaining traction in the industry for its ability to

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rapidly gather life data. By delivery times [1]. Accelerated testing is measures voltage pe

gaining traction in the industry for its ability to

trapidly gather life data. By subjecting products

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cost savings can be a rapidly gather life data. By subjecting products

to higher stress levels without introducing

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cost savings can be achieved [2]. Accelerated

cost savings can be achieved [2]. Accelerated

product re to higher stress levels without introducing

additional failure modes, significant time and

dielectric stream is low, a

cost savings can be achieved [2]. Accelerated

Life Testing (ALT) is utilized to assess

induces an additional failure modes, significant time and

cost savings can be achieved [2]. Accelerated voltage shortens insul.

Life Testing (ALT) is utilized to assess induces an electrical

product reliability by applying increas cost savings can be achieved [2]. Accelerated

Life Testing (ALT) is utilized to assess induces an elec

product reliability by applying increased stress, electric fields can

and statistical analysis of ALT data involves Life Testing (ALT) is utilized to assess indices an electr

product reliability by applying increased stress, electric fields can

and statistical analysis of ALT data involves dielectric compone

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the data. And because the relationship

between voltage and life conforms to the

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MLT is typically The data. And because the relationship

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inverse power law model, the experiment is

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stresses, which require length
 Keywords: Accelerated Life; Inverse Power

Law; Semi-parametric Hypothesis; Linear

Law; Semi-parametric Hypothe Fractional Conference on Social Development

and Intelligent Technology (SDIT2024)

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developed methods like Highly Accelerated

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developed methods like Highly Accelerated

Life Testing (HALT) and Highly Accelerated

Life Testing (HALT) and Highly Accelerated

design weaknesses example 15**
 U University, Suzhou, China

developed methods like Highly Accelerated

Life Testing (HALT) and Highly Accelerated

Stress Screening (HASS) to quickly reveal

design weaknesses and manufacturing defects.

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Stress Screening (HASS) to quickly reveal

design weaknesses and manufacturing defects.

The **Solution Studing Studing Studing Studing Studing Studing (HALT)** and Highly Accelerated Life Testing (HALT) and Highly Accelerated Stress Screening (HASS) to quickly reveal design weaknesses and manufacturing defects. The **Solution Community, Suzhou, China**
developed methods like Highly Accelerated
Life Testing (HALT) and Highly Accelerated
Stress Screening (HASS) to quickly reveal
design weaknesses and manufacturing defects.
These methods **EVALUAT:** Theorem is the Highly Accelerated Life Testing (HALT) and Highly Accelerated Life Testing (HALT) and Highly Accelerated Stress Screening (HASS) to quickly reveal design weaknesses and manufacturing defects. The U University, Suzhou, China
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Life Testing (HALT) and Highly Accelerated
Stress Screening (HASS) to quickly reveal
design weaknesses and manufacturing defects.
These methods apply ex developed methods like Highly Accelerated
Life Testing (HALT) and Highly Accelerated
Stress Screening (HASS) to quickly reveal
design weaknesses and manufacturing defects.
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Stress Screening (HASS) to quickly reveal
design weaknesses and manufacturing defects.
These methods apply extreme stress beyond
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Life Testing (HALT) and Highly Accelerated
Stress Screening (HASS) to quickly reveal
design weaknesses and manufacturing defects.
These methods apply extreme stress beyond
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Stress Screening (HASS) to quickly reveal
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These methods apply extreme stress beyond
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iden Stress Screening (HASS) to quickly reveal
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These methods apply extreme stress beyond
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identify and eliminate defects, known as the
st design weaknesses and manufacturing defects.
These methods apply extreme stress beyond
design specifications in a stepwise manner to
identify and eliminate defects, known as the
stepping stress test method [5]. Ideally, mo These methods apply extreme stress beyond
design specifications in a stepwise manner to
identify and eliminate defects, known as the
stepping stress test method [5]. Ideally, models
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identify and eliminate defects, known as the
stepping stress test method [5]. Ideally, models
should be grounded in physical or chemical
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stepping stress test method [5]. Ideally, models
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theories and validated empirically. In the
absence of such theories, empirical models stepping stress test method [5]. Ideally, models
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theories and validated empirically. In the
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based on extensive experience with failure
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theories and validated empirically. In the
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ALT theories and validated empirically. In the
absence of such theories, empirical models
based on extensive experience with failure
mechanisms can be used for extrapolation [6].
ALT is typically performed under constant
stres absence of such theories, empirical models
based on extensive experience with failure
mechanisms can be used for extrapolation [6].
ALT is typically performed under constant
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mechanisms can be used for extrapolation [6].
ALT is typically performed under constant
stresses, which require lengthy periods at low
stress levels to gather sufficient failure d mechanisms can be used for extrapolation [6].
ALT is typically performed under constant
stresses, which require lengthy periods at low
stress levels to gather sufficient failure data.
Ramp-stress loadings can yield faster ALT is typically performed under constant
stresses, which require lengthy periods at low
stress levels to gather sufficient failure data.
Ramp-stress loadings can yield faster failure
times compared to constant stresses, t stresses, which require lengthy periods at low
stress levels to gather sufficient failure data.
Ramp-stress loadings can yield faster failure
times compared to constant stresses, though
their reliability prediction accurac stress levels to gather sufficient failure data.

Ramp-stress loadings can yield faster failure

times compared to constant stresses, though

their reliability prediction accuracy remains

unverified. We develop test plans Ramp-stress loadings can yield faster failure
times compared to constant stresses, though
their reliability prediction accuracy remains
unverified. We develop test plans with varying
stress applications to match the statis times compared to constant stresses, though
their reliability prediction accuracy remains
unverified. We develop test plans with varying
stress applications to match the statistical
precision of constant-stress predictions their reliability prediction accuracy remains
unverified. We develop test plans with varying
stress applications to match the statistical
precision of constant-stress predictions [7].
Key experimental factors include humid unverthed. We develop test plans with varying
stress applications to match the statistical
precision of constant-stress predictions [7].
Key experimental factors include humidity,
voltage, electrical current, temperature, stress applications to match the statistical
precision of constant-stress predictions [7].
Key experimental factors include humidity,
voltage, electrical current, temperature, and
thermal cycling. Voltage stress, which
mea precision of constant-stress predictions [7].
Key experimental factors include humidity,
voltage, electrical current, temperature, and
thermal cycling. Voltage stress, which
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dielect Key experimental factors include humidity,
voltage, electrical current, temperature, and
thermal cycling. Voltage stress, which
measures voltage per unit thickness of a
dielectric, can lead to insulation breakdown if
it ex voltage, electrical current, temperature, and
thermal cycling. Voltage stress, which
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dielectric, can lead to insulation breakdown if
it exceeds certain levels. This breakdown
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occurs at weak points in the material, where
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dielectric, can lead to insulation breakdown if
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occurs at weak points in the material, where
dielectric strength is low, and generally, hig delectric, can lead to insulation breakdown if
it exceeds certain levels. This breakdown
occurs at weak points in the material, where
dielectric strength is low, and generally, higher
voltage shortens insulation life [8]. It exceeds certain levels. This breakdown
occurs at weak points in the material, where
dielectric strength is low, and generally, higher
voltage shortens insulation life [8]. Voltage
induces an electrical current, and stro occurs at weak points in the material, where
dielectric strength is low, and generally, higher
voltage shortens insulation life [8]. Voltage
induces an electrical current, and stronger
electric fields can accelerate the de delectric strength is low, and generally, higher
voltage shortens insulation life [8]. Voltage
induces an electrical current, and stronger
electric fields can accelerate the degradation of
dielectric components, causing fa voltage shortens insulation life [8]. Voltage
induces an electrical current, and stronger
electric fields can accelerate the degradation of
dielectric components, causing failures due to
growing discontinuities or electroc induces an electrical current, and stronger
electric fields can accelerate the degradation of
dielectric components, causing failures due to
growing discontinuities or electrochemical
reactions [9]. The inverse power relat

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International Conference on Social Development
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semi-parametric approach for robustness [10]. voltage is the single s

The section 2 introduces the specific voltages are selected International Conference on Social Development

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semi-parametric approach for robustness

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semi-parametric approach for robustness [10]. voltage is the single str

The section 2 introduces the specific voltages are select **and Intelligent Technology (SDIT2024)**

semi-parametric approach for robustness [10].

The section 2 introduces the specific voltages are selection as, simulation is used to prove the order of 80V, 1

consistency and asy and intention for constrained into the section for robustness [10].

The section 2 introduces the specific voltages are selected experimental methods of this experiment. In ascending section 3, simulation is used to prove semi-parametric approach for robustness [10]. voltage is the single

The section 2 introduces the specific

experimental methods of this experiment. In

section 3, simulation is used to prove the order of 80V, 100V

consi The section 2 introduces the sp
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section 3, simulation is used to prov
consistency and asymptotic normality c
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section 3, simulation is used to prove the order of 80V,
consistency and asymptotic normality of the variable method. The section 4 is the analysis of the that
real da

section 3, simulation is used to prove the

order of 80V,

consistency and asymptotic normality of the

real data. Finally, the section 5 summarizes the

other acceleration

experimental contents and draws a conclusion.
 consistency and asymptotic normality of the

real data. Finally, the section 5 summarizes the

real data. Finally, the section 5 summarizes the

experimental contents and draws a conclusion.
 2. Methodology
 2. Methodo method. The section 4 is the analysis of the

real data. Finally, the section 5 summarizes the

experimental contents and draws a conclusion. level. The relationship between

2. **Methodology**

The accelerated life experim **2. Methodology**

The accelerated life experiment should follow

the principle of selecting the appropriate

acceleration factor intensity level without

changing the failure mechanism of the battery.

In this

experiment **2. Methodology**

The accelerated life experiment should follow By taking the log (*T*) = log (*A*

the principle of selecting the appropriate $\log(T)$ is $\log(T)$ and $\log(T)$ are acceleration factor intensity level without 10 The accelerated life experiment should follow
the principle of selecting the appropriate
acceleration factor intensity level without
changing the failure mechanism of the battery.
In this tribution change is used as the a the principle of selecting the appropriate
acceleration factor intensity level without
danging the failure mechanism of the battery.
In this
density cover intensity level without
factor to charge is used as the accelerati

$$
log(t_{ij}) = log(A) + blog(V_i) + \epsilon_{ij}
$$
, i = 1, 2, 3, j = 1, 2, ..., N_i

influence In this

experiment, voltage is used as the acceleration

factor to charge and discharge the battery

cycle, and the method of constant current

charge and discharge is adopted. When the

charge and discharge is adopted.

the

factor to charge and discharge the battery

exercibe the irretime discovered interacter in

charge and discharge is adopted. When the

charge and discharge is adopted. When the

represented only by the

Therefore, an line eycle, and the method of constant current

charge and discharge is adopted. When the

represented only by the

Therefore, an linear regre

log $(t_{ij}) = \log(A) + \log(V_i) + \epsilon_{ij}$, i = 1, 2, 3, j = 1, 2, ..., N

can be used to estimat charge and discharge is adopted. When the
 $log(t_{ij}) = log(A) + blog(V_i) + \epsilon_{ij, i} = 1, 2, 3, j = 1, 2, 3, j$ lnerefore, an 1

lnerefore, an 1

can be used to estimate the parameters $\log(A)$ them. Since the

and b. Since the lifetimes follow a scale

distribution family with different scale

parameter and the stress factor will no can be used to estimate the parameters $log(A)$ + $log(B)$ + $log(B)$ + $log(B)$ and b. Since the lifetimes follow a scale
and b. Since the lifetimes follow a scale
distribution family with different scale
distribution family with di can be used to estimate the parameters log (A) them. Since the parameter
and b. Since the lifetimes follow a scale
distribution family with different scale
parameter and the stress factor will not
influence
other paramete Gauss-Markov theorem is satisfied. Therefore,
the
least square method can derive the best linear
unbiased estimator, which gives accuracy of
the estimate. In addition, the asymptotic
normality is satisfied under the Gauss

CONTROVERTY CONTROLLER SURFERENT CONTROVERTY
voltages are selected to be arranged in an ascending
order of 80V, 100V, 120V. The control
variable method was used in the test to ensure **CR** Academic Education
voltage is the single stress factor, the three
voltages are selected to be arranged in an
ascending
order of 80V, 100V, 120V. The control
variable method was used in the test to ensure
that ascending **CHE Academic Education**

voltage is the single stress factor, the three

voltages are selected to be arranged in an

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order of 80V, 100V, 120V. The control

variable method was used in the test to ensure

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 voltage is the single stress factor, the three
voltages are selected to be arranged in an
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order of 80V, 100V, 120V. The control
variable method was used in the test to ensure
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other acceleration factors were **Conserved Controllering Controllering Schemin**
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order of 80V, 100V, 120V. The control

variable method was used in the test **Academic Education**

voltage is the single stress factor, the three

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voltage is the single stress factor, the three

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variable method was used in the test to ensure

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voltages are selected to be arranged in an
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order of 80V, 100V, 120V. The control
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voltages are selected to be arranged in an
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order of 80V, 100V, 120V. The control
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other acceleration factors were voltage is the single stress factor, the three
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variable method was used in the test to ensure
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other acceleration factors were voltages are selected to be arranged in an
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order of 80V, 100V, 120V. The control
variable method was used in the test to ensure
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other acceleration factors were at the standard
level. The relationship betwee ascending
order of 80V, 100V, 120V. The contro
variable method was used in the test to ensur
that
other acceleration factors were at the standar
level. The relationship between the lifetime
and voltage is the power law, t order of 80V, 100V, 120V. The control
variable method was used in the test to ensure
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other acceleration factors were at the standard
level. The relationship between the lifetime
and voltage is the power law, that is: variable method was used in the test to ensure
that
other acceleration factors were at the standard
level. The relationship between the lifetime
and voltage is the power law, that is: $T = \frac{A}{v^B}$.
By taking the logarith that
other acceleration factors were at the standard
level. The relationship between the lifetime
and voltage is the power law, that is: $T = \frac{A}{V^B}$.
By taking the logarithm of lifetime, we have
 $\log(T) = \log(A) + \log(V)$, where

$$
log (A) + blog (Vi) + \epsilon_{ij}, i = 1, 2, 3, j = 1, 2, ..., Ni
$$
 (1)

Experiment should follow
and voltage is the power law, that is: $T = \frac{A}{V}$
experiment should follow
by taking the logarithm of lifetime, we have
electing the appropriate
intensity level without
intensity level without
 T changing the failure mechanism of the battery.

In this

developed in this generment, voltage is used as the acceleration

factor to charge and discharge the battery

experiment, voltage is used as the acceleration

descr and voltage is the power law, that is: $T = \frac{A}{v^B}$.
By taking the logarithm of lifetime, we have
log $(T) = \log(A) + \log(V)$, where $b = -B$.
3 test groups are assumed here with $V = 80$,
100, 120 respectively, and we have Ni units By taking the power law, yalat is. Γ v_B .
By taking the logarithm of lifetime, we have
log (T) = log (A) + blog (V), where b = -B.
3 test groups are assumed here with V = 80,
100, 120 respectively, and we have Ni unit By taking the logarithm of lifeltime, we have $\log(T) = \log(A) + \log(V)$, where $b = -B$.
3 test groups are assumed here with $V = 80$, 100, 120 respectively, and we have Ni units in the ith group. We used a scale distribution family acceleration factor $\Delta f = (\frac{V}{V})^B$ is the complete with $V = 80$,
3 test groups are assumed here with $V = 80$,
100, 120 respectively, and we have Ni units in
the ith group. We used a scale distribution
family to
describe $(\frac{v}{V})^B$ to complete the V = 80,
ith V = 80,
e Ni units in
distribution
a each group.
group is
ameter β_i .
del (1)
e process is
a specific
have to use
to complete the The interpretation in each group. We used a scale distribution
family to
describe the lifetime distribution in each group
The lifetime character in each test group is
represented only by the scale parameter β_i
Therefor describe the lifetime distribution in each group.
The lifetime character in each test group is
represented only by the scale parameter β_i .
Therefore, an linear regression model
 ϵ_{ij} , $i = 1, 2, 3, j = 1, 2, ..., N_i$ (1)
the represented only by the scale parameter β_i .

Therefore, an linear regression model
 ϵ_{ij} , $i = 1, 2, 3, j = 1, 2, ..., N_i$ (1)

them. Since the parameter estimate process is

semi-parametric, we do not assume a specific

di Therefore, an linear regression model
 ϵ_{ij} , i = 1, 2, 3, j = 1, 2, ..., N_i (1)

them. Since the parameter estimate process is

semi-parametric, we do not assume a specific

distribution family here, then we have to E_{ij} , i = 1, 2, 3, j = 1, 2, ..., N_i (1)
them. Since the parameter estimate process is
semi-parametric, we do not assume a specific
distribution family here, then we have to use
acceleration factor $A_f = (\frac{V}{V})^B$ to them. Since the parameter estimate process is
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120 a semi-parametric, we do not assume a specific
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3. **Simulation Study**
3.1 **Simulation Setting**
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International Conference on Social Development and Intelligent Technology (SDIT2024)

Voltage

80 100 120

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under 80V, 100V, 120V. Each experimental group carried out eight experiments, recording the battery life at different voltages, and finally calculating the average. In this way, we get the inference below, which is shown in the Table 5. The point estimates and CIs of $log(A)$ and b are derived along with the point estimates of **Publishing House**

under 80V, 100V, 120V. Each experimental

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under 80V, 100V, 120V. Each experimental

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189 100 1335 Inference below, which is shown in the Table

5. The point estimates and CIs of $\log(A)$ and

b are derived along with the point estimates of
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Mean Life (n) $419/$ 2821 1362 $A_{f(80)}$, $A_{f(100)}$ and

In Table 4, three experimental groups were set

up, respectively, the service life of the battery
 Table 5. Inference Outcomes of the Real Data Ana

log (A) in 1 able 4, three experimental groups were set

up, respectively, the service life of the battery

Table 5. Inference Outcomes of the Real Data Analys

Estimate
 $\frac{\log(A)}{20.0069}$
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 $\frac{4.7690}{4.764}$ up, respectively, the service life of the battery
 Table 5. Inference Outcomes of the Real Data An
 $\frac{\log(A)}{95\% \text{C1}}$ (14.6665, 25.3474) (-3.8322, -1.5075)

1-value 20.0069 -2.6699 3.50

1-value 7.7690 -4.764

5. **Con Extimate**
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Estimate 20.0069

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5. Conclusion R

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 5. Conclusion

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inverse power relationship between voltage

and battery life, underscoring the i the impact of voltage on battery life through

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inverse power relationship between voltage

of voltage as an acceleration factor in analysis. In

evaluating battery performance.

(pp. 1-2)

The key conclus mverse power relationship between voltage

and battery life, underscoring the importance

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The key conclusions are as follows:

The experimental findings and battery life, underscoring the importance

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The key conclusions are as follows:

The key conclusions are as follows:

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The key conclusions: are as follows: [3] Elsayed, E. A. (2C
 evaluating battery performance.

The key conclusions are as follows:

The experimental findings demonstrate that as

voltage increases, the battery life decreases

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significantly, which aligns with the The key conclusions are as follows:
The experimental findings demonstrate th
voltage increases, the battery life decre
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By constructing a linear regression mode voltage increases, the battery life decreases

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effect of voltage on battery longevity.

A new method

By constructing a linear regression significantly, which aligns with the inverse

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By constructing a linear regression model, we have method of accessfully estimated the power law and highlights the detrimental

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By constructing a linear regression model, we

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By constructing a linear regression model, we based on the Green and confirmed the effectiveness and reliability evaluation systems of the model. The use of a semi-pa By constructing a linear regression model, we based on the Grey

successfully estimated the effectiveness and relability

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product development to extend battery life. In

In summary, this study not only offers S

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- $A_{f(80)}$, $A_{f(100)}$ and $A_{f(120)}$. In addition, the

t-test shows the validity of the model.
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 (a) $A_{f(100)}$ $A_{f(120)}$
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