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Sequential Definitions of Continuity

Abstract. A function \( f : \mathbb{R} \to \mathbb{R} \) is continuous at \( a \in \mathbb{R} \) if for every \( \varepsilon > 0 \), there exists a \( \delta > 0 \) such that for all \( x \in \mathbb{R} \) with \( |x - a| < \delta \), we have \( |f(x) - f(a)| < \varepsilon \).

For real functions, the sequential definition of continuity at \( a \) is equivalent to the \( \varepsilon \)-\( \delta \)-definition.

References.

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We are now ready to define the continuity of a function. The basic
idea is that of a sequence of convergent sequences. A function $f$ is
defined to be continuous at a point $x$ if for every convergent sequence $\{x_n\}$ of points such that $\lim_{n \to \infty} x_n = x$, the limit
of the sequence $f(x_n)$ exists and is equal to $f(x)$. This
definition is made precise as follows:

\[
\lim_{n \to \infty} f(x_n) = f(\lim_{n \to \infty} x_n) = f(x)
\]

A function $f$ is continuous on a set $D$ if it is continuous at every point in $D$. A function is said to be continuous on an
interval $[a, b]$ if it is continuous at every point in the interval.

Continuity is a fundamental concept in calculus and analysis.
It plays a crucial role in the study of differentiable functions,
and is essential for the development of integral calculus.

Example 1. The function $f(x) = x^2$ is continuous on the interval $[0, 1]$. This is because for any sequence $\{x_n\}$
converging to $x$, the sequence $\{f(x_n)\}$ also converges to $f(x)$.

Example 2. The function $f(x) = \frac{1}{x}$ is discontinuous at $x = 0$. This is because the sequence $x_n = \frac{1}{n}$ converges
to $0$, but $f(x_n) = \frac{1}{\frac{1}{n}} = n$ diverges.

We now discuss some special classes of functions of sequential continuity.

Theorem 1. A function $f$ is sequential continuous if and only if
for every convergent sequence $\{x_n\}$ of points such that $\lim_{n \to \infty} x_n = x$, the limit of the sequence $f(x_n)$
equal $f(x)$.

Theorem 2. A function is sequential continuous if and only if it is
continuous.

To show that a function $f$ which satisfies the property

\[
\lim_{n \to \infty} f(x_n) = f(\lim_{n \to \infty} x_n) = f(x)
\]

for every convergent sequence $\{x_n\}$ of points such that $\lim_{n \to \infty} x_n = x$, then $f$ is sequential continuous.

Definition. Let $f$ be a function of sequential continuity and
n
\[
\lim_{u \to \infty} u = \infty
\]

\[
\sum_{u=1}^{n} u = \frac{n(n+1)}{2}
\]

\[
\sum_{u=1}^{n} u = \frac{n(n+1)}{2}
\]

Then $f$ is said to be a function of sequential continuity if

\[
\lim_{n \to \infty} f(x_n) = f(\lim_{n \to \infty} x_n) = f(x)
\]

for every convergent sequence $\{x_n\}$ of points such that $\lim_{n \to \infty} x_n = x$.
For an introduction to the theory of measure and integration (with respect to a general measure space), see [7], [17], [22], [25], [29]. The corrected version of the previous definition of measurable functions is given by [29].

For a sequence of measurable functions, see [7], [17], [22], [25], [29]. The corrected version of the previous definition of measurable functions is given by [29].

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The corrected version of the previous definition of measurable functions is given by [29].
be a C-continuous function, and let $a, b$ be a C-continuous function. Let $f : I \to \mathbb{R}$ be a C-continuous function. Then $f$ is continuous.

Proof. The first part of the proof is the same as that of Theorem 1. Using this lemma, we obtain the C-continuousness of the function $f$.

Theorem 1. Let $f$ be a regular method. Then $f$ is C-continuous.

Proposition 1. If $f$ is a regular method, then every mean function

$$f \in I : f$$

simple observation.

A sufficient condition for $f = J$. We begin with the following

Lemma 1. Let $a \neq 0$. If $J = I : f$ and $J = I : f$, then $a \neq 0$.

Lemma 2. If $a \neq 0$, then $J = I : f$.

In the following, we let

Please note that these steps, which is the emphasis of this

relationships between these three sets, which is the emphasis of this

If $f$ is C-continuous for strong matrix methods, $f$ will be

Introduction to strong matrix methods, see [20] and [31].

In this case, the strong A-limit of $x$ under the standard

The final class of methods that we want to discuss is given by strong
Definition. A method is called subsequential if whenever it is applied, it
contains a subsequential method and the comparison of its with C.

Condition for C. In this section we study the connection between
a topological view of C-continuity and a necessary


By Lemma 1 the inequality of follows.

\[ \lim_{n \to \infty} f(n) = \frac{2}{\pi} \left( \frac{\gamma - 0n}{\pi} + \frac{\gamma + 0n}{\pi} \right) \]

since \( q + n \nu = ((x)f)C = (n)f \)

of C, since \( f \) is C-continuous we finally have
so that C, \( q + n \nu = ((0q + 0\nu))C = ((x)f)C \).

Now let \( u \in I \) and let \((x, y) \in C\) such that \( x_i = \nu \).

\[ \nu \nu \nu \quad \nu \nu \nu \nu \nu \]

This implies that there is some \( x \in \mathbb{R} \) with

\[ \lim_{n \to \infty} f(n) = ((x)f)C \]

with \( f \) as C-continuous function, and let \( x \in \mathbb{R} \).

Then by the C-continuity of \( f \) we have that

\[ (x)f = ((x)f)C \]

since \( f \) is C-continuous and \( C \) is a regular method.

Let \( x \in \mathbb{R} \).

\[ (x)f = ((x)f)C \]

wherever \( u \) and \( v \) belong to I.

\[ (a)f(a + 1) + (n)f(a) = ((x)f)C = ((x)f)C = (a(\nu - 1) + n\nu)f \]

so that C, \( q + n \nu = ((0q + 0\nu))C = ((x)f)_C = ((x)f)C \) with

\[ (a)f(a - 1) + (n)f(a) = ((x)f)C \]

Hence or otherwise

\[ (a)f(a) = (a)f(a) \]

of course that \( x \) is \( (\nu) \) which equals \( u \).

\[ (a)f(a) = (a)f(a) \]

and a conductor \( C \) for which \( (\nu) = u \).

\[ (a)f(a) = (a)f(a) \]
we have established the claim.

\[ (f) \neq 0 \land (f) \notin \mathcal{D} \]

\[ \text{We claim that } f \text{ is not } \mathcal{D}-\text{continuous. Since } l \notin \mathcal{D}, \text{ there is a } \mathcal{D} \text{-\textit{closed}} \]

\[ \text{where } \mathcal{D} \text{ is a \textit{continuous} function such that } f \text{ and } x \text{ are } \mathcal{D} \text{-\textit{closed}}. \text{ Since } l \notin \mathcal{D}, \text{ there is a } \mathcal{D} \text{-\textit{closed}} \]

\[ \text{We suppose that } f \text{ is not } \mathcal{D}-\text{continuous and produce a \textit{continuous}} \]

\[ \text{Proof: We show that the inverse image of any } \mathcal{D} \text{-\textit{closed}} \text{ set is } \mathcal{D} \text{-\textit{closed}}. \]

\[ \text{Proposition 2. If } f \text{ is } \mathcal{D}-\text{continuous, then } f \text{ is } \mathcal{D}-\text{continuous.} \]

\[ \text{Proof. Let } \mathcal{D} \text{ be a regular method, then } \mathcal{D} \text{ is } \mathcal{D}-\text{continuous.} \]

\[ \text{Theorem 2. Let } \mathcal{D} \text{ be a regular method, then } \mathcal{D} \text{ is } \mathcal{D}-\text{continuous.} \]

\[ \text{Proof. We show that the inverse image of any } \mathcal{D} \text{-\textit{closed}} \text{ set is } \mathcal{D} \text{-\textit{closed}}. \]

\[ \text{Proposition 3. } \mathcal{D} \text{ is a regular \textit{subsequential method}, then } \mathcal{D} \text{ is } \mathcal{D}-\text{continuous.} \]

\[ \text{Theorem 3. If } \mathcal{D} \text{ is a \textit{subsequential method}, then } \mathcal{D} \text{ is } \mathcal{D}-\text{continuous.} \]

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\[ \text{Proposition 4. If } \mathcal{D} \text{ is a \textit{subsequential method}, then } \mathcal{D} \text{ is } \mathcal{D}-\text{continuous.} \]

\[ \text{Proof. We show that the } \mathcal{D} \text{-\textit{closed}} \text{ sets are } \mathcal{D} \text{-\textit{closed}}. \]

\[ \text{Definition. Let } \mathcal{D} \text{ and } \mathcal{D} \text{ be } \mathcal{D}-\text{continuous, then } l \text{ is in the } \mathcal{D}\text{-\textit{closed}} \text{ of } \mathcal{D}. \]

\[ \text{Proposition 5. } \mathcal{D} \text{ is } \mathcal{D}-\text{continuous.} \]

\[ \text{Proof. We show that the } \mathcal{D} \text{-\textit{closed}} \text{ sets are } \mathcal{D} \text{-\textit{closed}}. \]

\[ \text{Corollary 2. } \mathcal{D} \text{ is } \mathcal{D}-\text{continuous.} \]

\[ \text{Proof. We show that the } \mathcal{D} \text{-\textit{closed}} \text{ sets are } \mathcal{D} \text{-\textit{closed}}. \]
Theorem A. If \( G \) is a strong matrix method, then the following assertions are equivalent.

1. \( G \) is a \( \alpha \)-continuous strong matrix method for a suitable \( \alpha \).”

Note that each method \( J_0 \) coincides with a method of strong summability. Hence from the results of \( J_0 \) there follows the strong matrix method.

[\( J_0 \) is the question posed by Rice in the end of his paper.

We add that the method \( J_0 \) obviously gives an affirmative answer.

Now other functions.

In fact, by \( J_0 \), the function \( n \rightarrow 0 \) may be replaced by any other function.

(\( \text{Theorem A} \)) for some sequence \( (u_n) \).

\( \sum_n u_n = 0 \) \( \Leftrightarrow \sum_n u_n = 0 \).

Theorem B. \( \sum_n u_n = 0 \) \( \Leftrightarrow \sum_n u_n = 0 \).

The function \( u \rightarrow 0 \) is \( \alpha \)-continuous.

Theorem 3. \( \sum_n u_n = 0 \) \( \Leftrightarrow \sum_n u_n = 0 \).

It is clear that a regular matrix method that satisfies \( C \), where \( C = C \), is a strong matrix method by the definition of the method \( J_0 \). Therefore, the method \( J_0 \) is a regular matrix method.

For regular methods it is possible to characterize when the case \( C = C \) occurs.

For special methods it is possible to characterize when the case \( C = C \) occurs.

This shows that \( \sum_n u_n = 0 \) never produces different results.

We see from the previous two results that for a regular method \( C \) we have.

Theorem 2. We have given a regular subsequence method such that.

Theorem 2. The only \( \alpha \)-continuous functions are those that coincide with the convergence of the sequence of the function.

In Example 2, we have given a regular subsequence method such that

\[
\begin{align*}
0 & \leq \left| t - x \right| \sum_{n=1}^{\infty} \left| y_n \right| \\
& \leq \left| t - x \right| \sum_{n=1}^{\infty} \left| y_n \right| \\
& \leq \left| t - x \right| \sum_{n=1}^{\infty} \left| y_n \right|
\end{align*}
\]
We have that $\mathcal{C} \subseteq \mathcal{D}$ if and only if $f \in \mathcal{D}$ whenever $f \in \mathcal{C}$. Hence, by the definition of satisfiability, for all $x < 0$, there is an $\epsilon > 0$ such that $|f(x) - f(0)| < \epsilon / 2$. By the definition of $\mathcal{C}$, it follows that $f \in \mathcal{C}$ whenever $f \in \mathcal{D}$ if and only if $f$ is continuous at $x = 0$.

Proof: Clearly, the satisfaction of $\mathcal{C}$ is a logically regular method.

**Proposition A.** Let $f \in \mathcal{D}$ be a method of satisfaction.

Then the function $f(x) = \frac{1}{x}$ is continuous on $\mathbb{R}$.

**Theorem B.** Let $f$ be a method with property (S). Then every function $f$ that is $\mathcal{C}$-continuous at $x \in \mathbb{R}$ is also continuous.

Theorem C. There is no function $f$ with $x^{n}$ for which each subsequence converges to the same limit.

For methods of the cross-fusion variety.

4. A sufficient condition for $f \in \mathcal{C}$. We have seen that the space $\mathcal{C}$ is a cross-fusion variety.

**Corollary.** Let $f$ be a method with property (S). If $f$ is continuous at $x = 0$, then it is also continuous on $\mathbb{R}$.

Proposition D. Let $f$ be a method with property (S). If $f$ is continuous at $x = 0$, then it is also continuous on $\mathbb{R}$.

**Theorem E.** There is no function $f$ with $x^{n}$ for which each subsequence converges to the same limit.

For methods of the cross-fusion variety.

4. A sufficient condition for $f \in \mathcal{C}$. We have seen that the space $\mathcal{C}$ is a cross-fusion variety.
are special strong matrix methods. We have $\sum_1^\infty f = \delta = 0$, which
converges. Thus, Theorem 4.3 for our method. We will show that the
assertion holds for all $\delta$ in the sequence. Recall that the
matrix summand $f$ in the sequence is defined by strong
convergence.

We will show that the assertion holds for all $\delta$ in the sequence.

The spectral radius concept

corresponds to a counterexample to
test for regular matrix methods. Thus providing a counterexample to

No regular method exists for which there is a $C$-continuous function on

A function is $C$-continuous on $\mathbb{H}$ if and only if every continuous

Note, however, that the function is not $C$-continuous in this case.

Observe that there is a direct sum $\mathcal{M} + \mathcal{C}$. Let $0 \leq \mathcal{M} + \mathcal{C} = 0$.

Example 3. A regular method $\mathcal{C}$ is a function on $\mathbb{H}$ with

We will next see that Theorem 0 is not true for all regular methods.
0 = \frac{n}{\mu} \left( (0)\delta \right) \left( \int_0^1 \frac{n}{\mu} \frac{d}{d\mu} \int_0^n \frac{d}{d\mu} \right) = (n)\delta

\frac{0}{n} \neq \frac{n}{\mu} \left( (0)\delta \right) \left( \int_0^1 \frac{n}{\mu} \frac{d}{d\mu} \int_0^n \frac{d}{d\mu} \right) = (n)\delta

Since the functions \( \mu \) and \( \nu \) are continuous at \( \mu = n \), we have

\[ \mu \in [0, \mu_0] \]

the estimate being trivially true for \( n = 0 \). This shows that

\[ \frac{0}{n} \neq \frac{n}{\mu} \left( (0)\delta \right) \left( \int_0^1 \frac{n}{\mu} \frac{d}{d\mu} \int_0^n \frac{d}{d\mu} \right) = (n)\delta \]

Then we have for \( n \neq 0 \)

\[ 0 = \frac{n}{\mu} \left( (0)\delta \right) \left( \int_0^1 \frac{n}{\mu} \frac{d}{d\mu} \int_0^n \frac{d}{d\mu} \right) = (n)\delta \]

we can define

\[ \frac{0}{n} \neq \frac{n}{\mu} \left( (0)\delta \right) \left( \int_0^1 \frac{n}{\mu} \frac{d}{d\mu} \int_0^n \frac{d}{d\mu} \right) = (n)\delta \]

Remark. There is a regular matrix method for which

\[ \frac{0}{n} \neq \frac{n}{\mu} \left( (0)\delta \right) \left( \int_0^1 \frac{n}{\mu} \frac{d}{d\mu} \int_0^n \frac{d}{d\mu} \right) = (n)\delta \]

for every \( \mu \in [0, \mu_0] \), it does not satisfy this condition.

As noted at the end of the previous section, we do not know of a

\[ \mathbf{0} \subseteq \mathcal{C} \]

regular matrix method that does not satisfy this condition.

Following Anderson [11], we make the following assumption. Throughout this section, we use the certain kinds of dichotomy to hold. Our main tool will be the section.

In spite of these negative results, we will show in the remainder of this

\[ \mathbf{0} \subseteq \mathcal{C} \]

Corollary. There is a regular matrix method for which

\[ \mathbf{0} \subseteq \mathcal{C} \]

for every \( \mu \in [0, \mu_0] \), it does not satisfy this condition.

As noted at the end of the previous section, we do not know of a

\[ \mathbf{0} \subseteq \mathcal{C} \]

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\[ \mathbf{0} \subseteq \mathcal{C} \]

regular matrix method that does not satisfy this condition.

As noted at the end of the previous section, we do not know of a

\[ \mathbf{0} \subseteq \mathcal{C} \]
Let $x$ be a $C$-continuous sequence in $[a, b]$ with $C$-continuity on $[a, b]$ and uniformly on $[a, b]$.

Proof: Since $f$ is $C$-continuous, then $f = I(q)$.

Let $0 < |q - a| < \varepsilon$. Since $f$ is continuous, there exists a regular method. Assuming (C1), we have

$\varepsilon < (\infty) = \infty \cup (\infty) = (\infty)$

Suppose $f$ is continuous.

Lemma 2. Let $f$ be a regular method. Assuming (C1), we have

$0 \leq n < \infty$.

Suppose $f$ is continuous.

Theorem 3. For $n \geq 0$, we have

$n(0) + \varepsilon n(0)\varepsilon f + n(0)f(\varepsilon) = (n)^n$

Now, since each function $f$ is continuous on $\mathbb{R}$, we have

$\varepsilon(0) f + n(0) = (n)^n$

Substituting for $n$ and multiplying the equation by $u$, we obtain

$\varepsilon(0) f + n(0) = (n)^n$

with

$\varepsilon(0) f + n(0) = (n)^n$

Hence we can write

$\varepsilon(0) f + n(0) = (n)^n$

With this result, we can show that $f$ is continuous in $\mathbb{R}$.

Hence, we have shown that $f$ is continuous in $\mathbb{R}$.

We have shown that $f$ is continuous in $\mathbb{R}$.

This implies that $f$ is continuous in $\mathbb{R}$.

Hence, we have shown that $f$ is continuous in $\mathbb{R}$.

In addition, we have shown that $f$ is continuous in $\mathbb{R}$.

Otherwise, we would have

$\varepsilon(0) f + n(0) = (n)^n$

belonging to $\mathbb{R}$ as well.
Theorem 5.2

We thus obtain the following dichotomy, using also the corollary to

Proposition 4 and Theorem 8.

[8] Proposition 4 and Theorem 8 can be proved similarly as also the corollary to

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Proposition 4 and Theorem 8.
Lemma 4. Let \( R \subseteq \mathbb{R} \) be a function such that at every point

\[
\sigma x = (\frac{x}{q}) f - (\frac{x}{q}) f + q + u \nu x_0
\]

\( \forall x \in R \) and every \( x \) there are sequences \( x, x' \) with \( x' \rightarrow x \) and \( \sigma x' \rightarrow \sigma x \) on every point of \( \sigma x \) and every x. Then for every such \( x \). Let \( f \in C^\infty \), then \( \lim_{x \rightarrow x_0} \frac{f(x) - f(x_0)}{x - x_0} \) exists.

Since \( \sigma x = x \), \( x \) is \( \sigma \)-convergent to 0.

\[
((x - n \varepsilon f + q + u \nu x_0) \frac{x}{q}) f = (n) f
\]

(0 + q + u \nu x_0) \frac{x}{q} = (\frac{u}{q}) \left(\left( ((x - n \varepsilon f + q + u \nu x_0) \frac{x}{q}) f \right) \frac{x}{q} \right)

(0 + q + u \nu x) \frac{x}{q} = (\frac{u}{q}) \left(\left( ((x - n \varepsilon f + q + u \nu x_0) \frac{x}{q}) f \right) \frac{x}{q} \right)

\[
((x - n \varepsilon f + q + u \nu x) \frac{x}{q}) f = (n) f
\]

\[
((x - n \varepsilon f + (x) f) \frac{x}{q}) f = (n) f
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((x - n \varepsilon f) \frac{x}{q}) f = (n) f
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for all non-zero integers \( x \), we have

\[
\left( x^2 - 1 \right) / x = 0.
\]

and

\[
\gamma = (x^2 - 1) / x
\]

where

\[
\gamma = (x^2 - 1) / x
\]

and

\[
\gamma = (x^2 - 1) / x
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Since

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\gamma = (x^2 - 1) / x
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and

\[
\gamma = (x^2 - 1) / x
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we see that

\[
\gamma = (x^2 - 1) / x
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implies that \( \gamma \) are \( \gamma \)-connected with

\[
\gamma = (x^2 - 1) / x
\]

where

\[
\gamma = (x^2 - 1) / x
\]

and

\[
\gamma = (x^2 - 1) / x
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Since

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\gamma = (x^2 - 1) / x
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and

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\gamma = (x^2 - 1) / x
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we can express the \( \gamma \)-connectedness of

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\gamma = (x^2 - 1) / x
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and

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\gamma = (x^2 - 1) / x
\]

and
REFERENCES

property (L) That every function \( f : \mathbb{R} \to \mathbb{R} \) is \( \mathcal{C} \)-continuous.

Theorem II (Spiegel-Krypiuk) Let \( f \) be a regular function with

\[ f(x) = \begin{cases} 0 & \text{if } x \in \mathbb{Q} \\ 1 & \text{if } x \notin \mathbb{Q} \end{cases} \]

for all \( x \in \mathbb{R} \). Then \( f \) is \( \mathcal{C} \)-continuous.