

# Document for class 3

Rashad Mahmudov

March 16, 2020

## 1 Introduction

Curves and surfaces are usually defined with a minimum assumption like differentiability or rectifiability. This hypothesis seems to be natural and are useful to access to some basic properties such that the possibility to compute the length of a curve  $C(t)$  between to point  $C(a)$  and  $C(b)$  :  $L = \int_a^b ||C'(t)|| dt$ . But what arise if these hypothesis are not verified? Is it possible to defined curves which are no-where differentiable? Is it possible to control they geometry? The fractal theory gives numerous answers of these questions.

This chapter is not devoted to fractal geometry and it don't give answer to all of these questions. But it describes how it is possible to use the fractal paradigm to design a set of curves which are not possible to describe with others models because of the simple fact that these models made the assumption of the differentiability.

## 2 Some math

In this section we gives some mathematics results used in this course. Profs can be found.

**Definition 1** (Contraction). Let  $(\chi, d)$  be a metric space. Let  $f$  be a transformation on  $(\chi, d)$ .  $f$  is a contraction  $(\chi, d)$  iff  $\exists s \in \mathbb{R}, s < 1$  tq  $\forall x, y \in \chi, d(f(x), f(y)) \leq s \times d(x, y)$

**Definition 2** (Banach Fixed Point theorem). Let  $(\chi, d)$  be a non-empty complete metric space and  $f$  a contraction on  $(\chi, d)$ . Then, there exists a unique point  $x \in \chi$ , named the fixed point of  $f$ , verifying  $f(x) = x$ .

## 3 Lists example

1. First entry
2. Second entry
3. Third entry

- First entry
- Second entry
- Third entry

### 3.1 Package enumerate

This package gives the `enumerate` environment an optional argument which determines the style in which the counter is printed. An occurrence of one of the tokens `A` `a` `I` `i` or `1` produces the value of the counter printed with (respectively) `\Alph` `\alph` `\Roman` `\roman` or `\arabic`. These letters may be surrounded by any strings involving any other TEX expressions, however the tokens `A` `a` `I` `i` `1` must be inside a group if they are not to be taken as special.

You have to load package `enumerate` writing `\usepackage{enumerate}`.

#### Examples

EX i. one one one one one one one one one one

EX ii. two

example a) one of two one of two one of two

example b) two of two

#### Remark

For writing L<sup>A</sup>T<sub>E</sub>X code inside L<sup>A</sup>T<sub>E</sub>X document you have to load and use `verbatim` package.