

CONTENTS

- INTRODUCTION
- TYPES OF FD
- FULL FD
- TWO LEVEL FULL FD
- THREE LEVEL FULL FD
- FRACTIONAL FD
- SUMMARY
- REFERENCES

Factorial Design : (FD)

- **Factorial experiment is an experiment whose design consist of two or more factor each with different possible values or “levels”.**
- **FD technique introduced by “Fisher” in 1926.**
- **Factorial design applied in optimization techniques.**

Factors :

- **Factors can be “Quantitative” (numerical number) or they are qualitative.**
- **They may be names rather than numbers like Method 1, site B, or present or absent .**

- Factorial design depends on **independent variables** for development of new formulation .
- Factorial design also depends on **Levels** as well as **Coding**

There are **three** types of **levels** :

- 1) **LOW**
- 2) **INTERMEDIATE**
- 3) **HIGH**

Simultaneously **CODING** takes place for Levels :

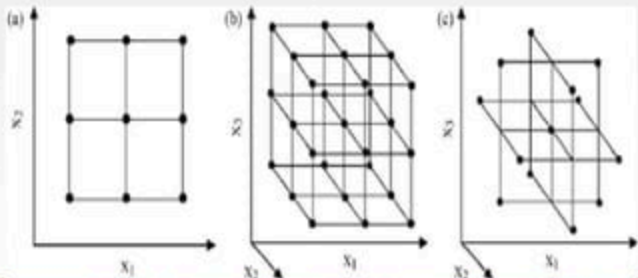
- 1) for **LOW** = **(-1)**
- 2) For **intermediate** = **(0)**
- 3) for **HIGH** = **(+1)**

Types of Factorial Design

Factorial Design can be either

➤ Full FD

➤ Fractional FD



Full Factorial Design

A design in which every setting of every factor appears with setting of every other factor is full factorial design

If there is k factor , each at Z level , a Full FD has Z^k



(Levels)^{Factors} · \rightarrow [Z^k]

➤ Factorial Design : 2^2 , 2^3 , 3^2 , 3^3

2^2 FD = 2 Factors , 2 Levels = 4 runs

2^3 FD = 3 Factors , 2 Levels = 8 runs

3^2 FD = 2 Factors , 3 Levels = 9 runs

3^3 FD = 3 factors , 3 Levels = 27 runs

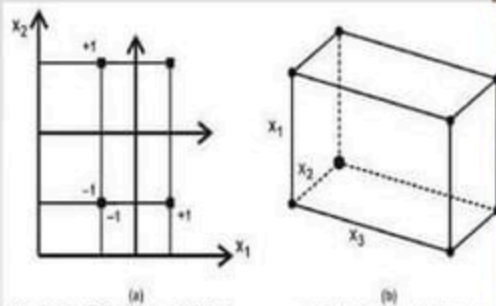


Fig 3. (a) 2^2 full factorial design

(b) 2^3 full factorial design

➤ TWO Levels Full FD :

2 factors : X_1 and X_2 (Independent variables)

2 levels : Low and High

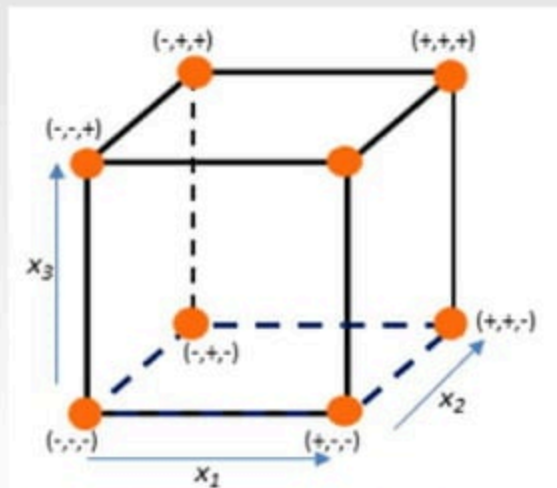
Coding : (-1) , (+1)

	+	-
+	++	+-
-	-+	--

Three level Full FD :

In three level factorial design ,
three levels are use ,

- 1) low (-1)
- 2) intermediate (0)
- 3) high (+1)



FRACTIONAL FACTORIAL DESIGN

- In Full FD , as a number of factor or level increases , the number of experiment required exceeds to unmanageable levels .
- In such cases , the number of experiments can be reduced systemically and resulting design is called as Fractional factorial design (FFD).
- Applied if no. of factor are more than 5 .

SUMMARY

- Factorial design depends on Factors and Levels.
- Factorial design also depends on Variables.
- Factorial design divide in either in Full FD and Fractional FD (FFD)
- Full FD have two types : Two levels and Three level Full FD
- Full FD not applicable to factors more than 5.
- Fractional FD overcome on the limitation of Full FD (applicable to factors more than 5)

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Thank You