

## Case Study L1-007

### Semantic Precision in Patent NMT

Domain Polysemy (The "Cuddly" Exosuit)

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#### Case Study Metadata

**Dataset ID:** L1-007

**Category:** Semantic Precision — Level 1

**Focus:** Material vs. Textural Properties

**Model:** Generic NMT

**Domain:** Soft Robotics / Biomechanics

## 1 The Context: Mechanical Compliance

In the field of **Soft Robotics**, the term "Soft" refers to a specific mechanical property: **Compliance**. It describes systems built from non-rigid materials (elastomers, textiles, cables) rather than rigid links. In French, the correct technical term for "non-rigid/compliant" is "**Souple**".

### Key Concept

#### The Polysemy Trap:

The word "Soft" is highly polysemous in general English.

- *Soft pillow* → **Doux** (Texture: smooth, gentle).
- *Soft software* → **Logiciel** (IT context).
- *Soft metal* → **Mou** (Hardness scale).
- *Soft mechanism* → **Souple** (Flexibility).

Generic NMT models, trained on vast amounts of general lifestyle data, have a strong bias toward "Doux" (Gentle/Comfortable) when the object is "Wearable."

## 2 The Glitch: The "Gentle" Robot

In Claim 1, the generic model interpreted "Wearable Soft Exosuit" as a piece of clothing described by its comfort, rather than a machine described by its mechanics.

### 2.1 Forensic Evidence (Claim 1)

### 2.2 Why This Matters

- **Property Shift:** The patent claims a device with specific **mechanical** characteristics (compliance). The translation claims a device with **textural** characteristics (smoothness).

Source Term (English)	NMT Output (Hallucination)	Golden Rewrite (Correct)
"A wearable <b>soft</b> exosuit..."	× "...Exocombinaison <b>douce</b> ..." (Meaning: Gentle / Cuddly)	"...Exocombinaison <b>souple</b> ..." (Meaning: Flexible / Compliant)

Table 1: Polysemy Failure in Soft Robotics

- **Consistency Oscillation:** In Claim 2, the model briefly switched to the correct term ("Souple"), only to revert to "Douce" in Claim 7, creating an inconsistent definition of the invention.
- **Absurdity:** An "Exocombinaison douce" sounds like a piece of lingerie or a plush toy, undermining the seriousness of the technical disclosure.

### 3 Alignment Methodology

#### 3.1 Domain-Vector Constraints

To resolve this, we enforce a **Context-Specific Mapping** that overrides general frequency.

#### Alignment Methodology

##### The "Soft" Disambiguation Protocol:

1. **Domain Detection:** Identify context markers: [Exosuit], [Actuator], [Robot], [Mechanism].
2. **Vector Locking:** If Domain = ROBOTICS or MECHANICS:
  - **Ban:** *Doux, Douce* (Texture).
  - **Ban:** *Mou, Molle* (Lack of strength).
  - **Force:** *Souple* (Flexible/Compliant).
3. **Consistency Check:** Once "Souple" is selected in the Title/Claim 1, lock it as the canonical term for the entire document to prevent oscillation.

## 4 Key Insights

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### Key Concept

#### What This Case Study Demonstrates:

1. **Wearability Bias:** The AI saw "Wearable" and pivoted to "Clothing/Comfort" logic instead of "Machine" logic.
2. **Oscillation is Proof of Confusion:** The fact that the model switched between "Douce" and "Souple" proves it did not understand the concept, but was guessing based on local sentence probability.
3. **The Need for Training:** "Soft Robotics" is a distinct field. Without fine-tuning on this specific IPC class (B25J), generic models will fail.

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**Portfolio:** Patent Translation AI Alignment Framework

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