

# **DIFFERENTIAL FORMS**

*A Complement to Vector Calculus*

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# DIFFERENTIAL FORMS

*A Complement to Vector Calculus*

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# ACKNOWLEDGMENTS

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In the writing of this book and in the creation of the accompanying software, I have had help from many sources.

Two people have made central contributions. Mark J. Schaefer, formerly of Tübingen University, helped write the initial C++ code. His brilliant programming skills were much needed, and it was his idea to identify quantities correct to the last decimal place with a terminal tilde.

Norman Naugle of Texas A & M University supplied the  $\text{\TeX}$  software used in writing this book.

My thanks to all, many unmentioned, for their help.

**Oliver Aberth**

# PREFACE

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One of the more striking developments in the history of the generative paradigm has been the resurrection and subsequent elaboration of a separate morphological component. It is true that for the most part, this development did not come about because of any special concern for morphological problems, *per se*—on the contrary, it was motivated primarily by concerns internal to the syntax and the phonology. In this chapter we will review the recent history of morphological theorizing.

This is different in a number of respects from the models discussed above. This model is incorporated into a theory of grammar referred to as Autolexical Syntax (AS), a theory proposed in recent work by Sadock (1985, 1987, this volume). The central claim of this theory is that the requirements of the morphology, syntax, and semantics are satisfied in different components and then mapped onto each other to propose additional strata, with a regular inflection. Problems arise within simple models of LP like the one presented arrangement of strata inserted in Stratum 3 along with regular inflection. Problems arise within simple models of LP like Stratum 1, which have led various researchers to propose additional strata, a different arrangement of strata, and various restrictions on the rule application (e.g., Halle and Monaghan, 1985).

*Steven H. Weintraub*

## **PART I**

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*THIS IS THE PART TITLE*



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# INTEGRATION OF DIFFERENTIAL FORMS OVER ORIENTED MANIFOLDS

In this chapter, which might also be titled the “sense-nonsense discrimination,” the generally accepted conventional wisdoms are presented in sufficient detail to show why they fail to account for a functional immune system. There are many views which may make up the conventional wisdoms, too many to require an interpretation of the self-nonsense discrimination.

## I THE INTEGRAL OF A 0-FORM OVER A POINT (EVALUATION)

Here is some normal text. Here is some normal text.

### I.1 This is a test subsection

Here is some normal text. Here is some normal text. Here is some normal text.  
Here is some normal text. Here is some normal text. Here is some normal text.  
Here is some normal text.

I.1.1 This is a subsubsection Here is some normal text. Here is some normal text.  
Here is some normal text. Here is some normal text. Here is some normal text.  
Here is some normal text. Here is some normal text.

**TABLE I.1** Small Table

one	two	three
Very	Small	Table Here

*Paragraph* Here is some normal text. Here is some normal text. Here is some normal text. Here is some normal text. Here is some normal text. Here is some normal text. Here is some normal text. Here is some normal text.

## 2 HERE IS A REALLY LONG TITLE THAT NEEDS TO BE SEEN ON TWO LINES

When using the square bracket optional arg with a section command, you will send the text in square brackets to the running head and table of contents; the text in curly brackets will print on the page.

Here is our first equation;

$$\text{error} \leq \frac{1}{2} \cdot 10^{-k} \quad (1.1)$$

and for an equation that is split over a number of lines:

$$\begin{aligned} (x + y)(x - y) &= x^2 - xy + xy - y^2 \\ &= x^2 - y^2 \end{aligned} \quad (1.2)$$

$$= x^2 + 2xy + y^2 \quad (1.3)$$

An equation with a big curly:

$$f_a(x) = \begin{cases} a \sin \frac{x}{a} & \text{if } a \neq 0 \\ 0 & \text{if } a = 0 \end{cases} \quad (1.4)$$

A footnote appears at the end of this line.<sup>1</sup> The text of the footnote will appear at the end of the chapter.

This is different in a number of respects from the models discussed above. This model is incorporated into a theory of grammar referred to as Autolexical Syntax (AS), a theory proposed in recent work by Sadock (1985, 1987, this volume).<sup>2</sup>

**FIGURE I.1** Short caption.

Here is a sample quotation which may go on for several paragraphs.  
Here is a sample quotation which may go on for several paragraphs.

### A-Group Theorem Type Environments

*Proof:* Here is a proof of a proof which is indeed proven and may be considered final.

**FIGURE 1.2** Here is a long caption that will form into the shape of a paragraph. Here is a long caption that will form into the shape of a paragraph.

**TABLE 1.2** Interval Solutions to the Interval Equation System 7.3 Obtained in Three Ways

	Method 1	Method 2	Method 3
$x_1$	[1.2325, 1.2607]	[1.2328, 1.2604]	[1.2415~]
$x_2$	[0.5609, 0.5752] <sup>a</sup>	[0.5610, 0.5750]	[0.5640~] <sup>b</sup>

<sup>a</sup>Refs. 19 and 20.

<sup>b</sup> $\kappa, \lambda > 1$ .

*Remark:* Here is a remark that will let you know exactly what was meant by the previous statement, or at least point out what the author would like to convey more adequately.

*Claim:* This is a claim, which we certainly hope is not spurious, but which can be taken exceptionally seriously.

## B-Group Theorem Type Environments

**COROLLARY 2.1:** *Yet, as we think about it, there are more implications of the previous theorem. One corollary is included in the following...*

**THEOREM 2.1:** *Here is a theorem. Here is a theorem. Here is a theorem. Here is a theorem. Here is a theorem. Here is a theorem.*

**PROPOSITION 2.1:** *Here is a proposition. Here is a proposition. Here is a proposition. Here is a proposition. Here is a proposition. Here is a proposition. Here is a proposition. Here is a proposition.*

**LEMMA 2.1:** *Here is a lemma. Here is a lemma. Here is a lemma. Here is a lemma. Here is a lemma. Here is a lemma. Here is a lemma. Here is a lemma.*

## C-Group Theorem Type Environments

**DEFINITION 2.1:** Here is a first definition. Here is a first definition. Here is a first definition.

**DEFINITION 2.2:** Here is a second definition with an itemized list included within the definition:

- 1) The immune system is based on three principles which have been put into the form of three laws.
- 2) The first Law states that “any mechanism of host defense.

- 3) Against recognitive form of a corollary, the immune system is defined as one that undergoes a learned (somatic) discrimination.

EXAMPLE 2.1: Here is an example. Here is an example. Here is an example. Here is an example. Here is an example. Here is an example.

NOTATION 2.1: Here is another environment; the notation. Here is another environment; the notation. Here is another environment; the notation. Here is another environment; the notation.

### Making new theorem environments

NON-SOLVABLE PROBLEM 2.1: *For any two numbers  $a$  and  $b$ , decide whether or not  $a \circ b$ , where  $\circ$  may be one of these relations  $>$ ,  $\leq$ ,  $<$ , or  $\geq$ .*

and,

NON-SOLVABLE PROBLEM 2.2: *For any two numbers  $a$  and  $b$ , select the single correct relation from these three:  $a < b$ ,  $a = b$ , or  $a > b$ .*

Then, there are some solvable problems, fortunately!

SOLVABLE PROBLEM 2.1: For any number  $a$  and any two unequal numbers  $b_1$  and  $b_2$ , choose either  $b_1$  or  $b_2$  as a number unequal to  $a$ .

SOLVABLE PROBLEM 2.2: For any two numbers  $a$  and  $b$  and any specified positive integer  $n$ , select a correct relation from these three:  $|a - b| < 10^{-n}$ ,  $a < b$ , or  $a > b$ .

### Sample Unnumbered Algorithm

ALGORITHM 1.

```

state transition algorithm {
  for each neuron  $j \in \{0, 1, \dots, M - 1\}$ 
  {
    calculate the weighted sum  $S_j$  using Eq. (6);
    if ( $S_j > t_j$ )
      {turn ON neuron;  $Y_1 = +1$ }
    else if ( $S_j < t_j$ )
      {turn OFF neuron;  $Y_1 = -1$ }
    else
      {no change in neuron state;  $y_j$  remains unchanged;} .
  }
}

```

**EXERCISES**

1. Given the set of vectors to intuition rather than evolution as the arbiter when this chapter, which also be titled the
  - a) the generally accepted conventional wisdoms are?
  - b) presented in sufficient detail?
  - c) to show why they fail to account for a functional immune system to show why they fail to account for a functional immune system to show why they fail to account for a functional immune system
2. For each system of equations below
  - a)  $3x - 2y = 2$       b)  $9y - x = 4$
  - c)  $-3x - 9y = -6$     d)  $x - 8y = 6$
3. Here are some more examples to try:
  - a)  $3x - 2y = 2$     b)  $9y - x = 4$     c)  $-3x - 9y = -6$
  - d)  $2x - 2y = 2$     e)  $20y - x = 4$
4. The following data were collected in a study of the effect of dissolved sulfur on the surface tension of liquid copper (Baes and Killogg, 1953).

$x = \text{Weight \% sulfur}$	$Y = \text{Decrease in Surface Tension}$ (dynes/cm), two Replicates	
0.034	301	316
0.093	430	422
0.30	593	586

- a) Find the transformations of  $X$  and  $Y$  so that in the transformed scale the regression is linear.
- b) Assuming that  $X$  is transformed to  $\ln(X)$ , which choice of  $Y$  gives better results,  $Y$  or  $\ln(Y)$ ? (Sclove, 1972).

**NOTES**

N1.1. Here is some sample footnote text. Here is a footnote. Here is a footnote.

N1.2. The reader familiar with determinants will note the appearance of

$$\det \begin{pmatrix} x_1 & y_1 \end{pmatrix} \text{ and } \det \begin{pmatrix} x_1 & y_1 & z_1 \end{pmatrix}$$

in the above computations. It is no accident!

**APPENDIX: HERE IS A CHAPTER APPENDIX**

A chapter appendix is formatted somewhat differently than an appendix found at the end of the book. This is a chapter appendix.

123abc (A.1)

**APPENDIX**

A chapter appendix is formatted somewhat differently than an appendix found at the end of the book. This is a chapter appendix.

123abc (B.1)

**REFERENCES**

1. J. S. Kilby, "Invention of the Integrated Circuit," *IEEE Trans. Electron Devices*, **ED-23**, 648 (1976).
2. R. W. Hamming, *Numerical Methods for Scientists and Engineers*, Chapter N-1, McGraw-Hill, New York, 1962.
3. J. Lee, K. Mayaram, and C. Hu, "A Theoretical Study of Gate/Drain Offset in LDD MOSFETs" *IEEE Electron Device Lett.*, **EDL-7**(3). 152 (1986).
4. A. Berenbaum, B. W. Colbry, D.R. Ditzel, R. D Freeman, and K.J. O'Connor, "A Pipelined 32b Microprocessor with 13 kb of Cache Memory," *Int. Solid State Circuit Conf., Dig. Tech. Pap.*, p. 34 (1987).

# ANSWERS TO EXERCISES

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## CHAPTER I

### Section 1

- a)  $(4x^2 - x) dx + 2xy + x dy$   
b)  $x^2 dx + (-x^2 + 2xy + x + y) dy$   
c)  $4x^2 - x) dx + 2x dy$
- a)  $(4x^2 - x) dx + 2xy + x dy$   
b)  $x^2 dx + (-x^2 + 2xy + x + y) dy$   
c)  $4x^2 - x) dx + 2x dy$

### Section 2

- a)  $(4x^2 - x) dx + 2xy + x dy$   
b)  $x^2 dx + (-x^2 + 2xy + x + y) dy$   
c)  $4x^2 - x) dx + 2x dy$
- a)  $3x - 2y = 2$       b)  $9y - x = 4$   
c)  $-3x - 9y = -6$       d)  $x - 8y = 6$
- a)  $3x - 2y = 2$       b)  $9y - x = 4$       c)  $-3x - 9y = -6$   
d)  $2x - 2y = 2$       e)  $20y - x = 4$

# REFERENCES

- 
1. Anderson, Terry L., and Fred S. McChesney. (n.d.). "Raid or Trade? An Economic Model of Indian-White Relations," Political Economy Research Center Working Paper 93-1.
  2. Lacey, W.K. (1968). *History of Socialism*. Ithaca, NY: Cornell University Press.
  3. Oliva, Pavel. (1971). *Sparta and Her Social Problems*. Amsterdam: Adolf M. Hakkert.
  4. Zimmern, Alfred. (1961). *The Greek Commonwealth: Politics and Economics in Fifth-Century Athens*, 5th ed. New York: Galaxy Book, Oxford University Press.

# APPENDIX

## Why Does a Mirror Reverse Left and Right?

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**T**he immune system is based on three principles which have been put into the form of three laws. The first states that “In the immune system, antigen-specific cells have two states of responsiveness to antigens of the consequences of appealing to intuition rather than evolution as the arbiter when choosing one.

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