

LA RELACION DE LANE MODIFICADA

X^qevqt'O ki wriRqpeg"

Rtqhgut "f g'kpi gplet'c'Ekkl'{'Co dkgvnc"

Wpkxgtul'cf 'Guncvrf'g'Ucp'F'kgi q"

Ucp'F'kgi q.'Ecnkhtpkc.'; 434; /3546'WUC'"

r qpegB r qpeguf uwgf w

Introducción

Gp" gung" vcdclq" ug" o qf kkec" n" tgrcel»p" f g" Ncpg" *Ncpg." 3; 77+<

S_u"f_u"S_y"U_q"]3_ " gp'nc'ewcn'S_u"? "f guecti c'w>rkf c=S_y"? "f guecti c'hf>wkf c=f_u"? "vco c° q" o gf kq" f g" ncu" r ct'vewrcu" { "U_q"? " r gpf kqpv" f g" n" eqttkqpv0

Nc" pwxc" tgrcel»p" ug" gzrtguc" eqo q" vpc" gewcel»p" cf ko gpukqpcn" o gf kcpvg" gn'tggo r n" q'f gn'vco c° q" o gf kq" f g" ncu" r ct'vewrcu" *f_u" r qt" n" hwpele»p" f g" n" twi qukf cf "tgrvkc" *f_u"π³⁵" { "n" eqpxgtukp" f g" S_y" c" wpl'cf gu" f g" hwgt| c0'Nc" f g'kxcel»p" f g'nc'pwxc" tgrcel»p" ug'f g'vcm" c" eqp'vpcel»p0

La Función de Fricción

Nc'hg' { "f g'htleek»p'ewcf t° vlc. "gp'nc'ewcn'ug'dcuc'nc'gewcel»p" f g'Ej gl { ".gu"Rqpeg" { "Uko qpu." 3; 99+<

q"?" "h'x⁴"]4_ " gp'nc'ewcn' q"?" guhwgt| q" eqt'vcpvg" f g'dkf q" c" n" htleek»p" f g" hqpf q=" "?" f g'pukf cf "f gn'ci wc=h"?" eqghleek»p" cf ko gpukqpcn' f g'htleek»p." gu'ewcn'gu'ki wcn'c'3I: "f gn'eqghleek»p" f g'F cte{/ Y gludcej = { "x"?" xgnqekf cf "o gf k'f g'nc'eqttkqpv0

F g'qvt q'ncf q." gn'guhwt| q" eqt'vcpvg. "gp'v° to kpu'f g'xctkcdrgu" j kf t° wlecu." gu"Ej qy .3; 7; +<

q"?" "T"U_q"]5_ " gp'nc'ewcn' "?" "r guq" wpkctkq" f gn'ci wc={ "T"?" "tcf kq" o gf kq" j kf t° wleq0"

Eqo dkpcpf q'ncu'gewekqpgu'4" { "5< U_q"? "h'x⁴"T° T°+]6_ "

Grip'Ào gtq'f g'htqwf g'gu"Ej qy .3; 7; +< H"?" "x" T° F³⁵"]7_ "

gp'nc'ewcn'F"?" "vcpvg" j kf t° wlecu." F"?" "C IV." gp'nc'ewcn'C"?" ° tgc'f g'hwq={ "V"?" cpej q'f g'nc'uw g'htleek'kdtg0

Eqo dkpcpf q'ncu'gewekqpgu'6'cpf '7< U_q"? "h" F π +H⁴"]8_ "

Gp'nc'ewcn'f g'vpc'epcn'j kf t° wleco gpvg'cpej q<F ° T0" Rqt'nc'vcpv< U_q"? "h" H⁴"]9_ "

Gunc' Àmo c" gewcel»p" gucdrgg" n" r tqr qtekqpcrkf cf "f g" n" hwgt| c'f g' t'cxgf cf "U_q" eqp'nc'hwgt| c'f g'htleek»p" h0

La Función de Transporte de Sedimentos"

Wpc" hwpele»p" i gpgtci' f g" vcpur qtvg" f g" ugf ko gpvqu" gu" n" uki wkpvg" Rqpeg." 3; : : +<

s_u"?" "m³x° ""]: _ " gp'nc'ewcn's_u"? "f guecti c'w>rkf c." r qt" wpl'cf "f g" cpej q=" "?" f g'pukf cf "f gn'ci wc=h"?" eqghleek»p"={ "o"?" "gzr qpgpv0

F g" cewgtf q" c" Eqnd { "°3; 86+." gn'gzr qpgpv" o "xct'c" gp'nc' t'cpi q" 5" 0" o "0' 90' Nqu" xcmqtgu" o gpqtgu" eqttgur qpf gp" c" f guecti cu'cnuc. " { "hu'xcmqtgu" o c { qtgu'c'f guecti cu'dclcu0

Cu'Ào cug" swg" o "° 5" eqo q' r tko gtc" cr tqzko cel»p" xcmqtgu" cnqu'f g'f guecti c'nf>wkf c" { "w>rkf c-0' Gp" gung'ecuq. nc'hwpele»p" f g'vcpur qtvg' f g' ugf ko gpvqu'gu<

s_u"?" "m³x⁵"]: _ " gp'nc'ewcn'm³ gu'vpc'eqghleek»p" cf ko gpukqpcn0

Nc'f guecti c'nf>wkf c' r qt" wpl'cf "f g" cpej q" gu< s"?" "x" f " "]32_ "

Nc'eqpegvpcel»p" f g' ugf ko gpvqu'gu< E_u"?" "s_u k" "]33_ "

Eqo dkpcpf q'ncu'gewekqpgu', "cpf '33< E_u"?" "m³x⁴ f " "]34_ "

Gp'vpc'epcn'j kf t° wleco gpvg'cpej q. f ° F 0 Eqo dkpcpf q'ncu' gewekqpgu'7" { "34." nc'eqpegvpcel»p" f g' ugf ko gpvqu'gu<

E_u"?" "i" m³ H⁴"]35_ "

Eqo dkpcpf q'ncu'gewekqpgu'9" { "35< E_u"?" "m³ U_q h⁴" "]36_ "

Nc' tgrcel»p" gpvt g'nc'eqghleek»p" f g' htleek»p" h' { "gn'eqghleek»p" p" f g" twi qukf cf "f g" O cplpi . "gp" wpl'cf gu" UK" gu" *Ej qy . 3; 7; +<

h"?" "p⁴ T³⁵"]37_ "

Gp'wpl'cf gu'co gtlecpuc< h"?" "p⁴ T³⁵ 8⁴ T³⁵ 4"]38_ "

Rqt'nc'vcpv. "gp" i gpgtci< h"?" "m³ p⁴ T³⁵"]39_ "

Gp'wpl'cf gu'UK< m³"?" "i" ?; 0 3"]3: _ "

Gp'wpl'cf gu'co gtlecpuc< m³"?" "1306: 8⁴"? "54089" T4042: "? 36079"]3; _ "

La Relación de Strickler"

Nc' tgrcel»p" f g' Utlemgt "gpvt g'nc'eqghleek»p" p" f g" twi qukf cf " f g" O cplpi " { "gn' vco c° q" o gf kq" f g" n" r ct'vewrcu" f 72" gu" *Ej qy . 3; 7; +<

p"?" "m³ f₇₂ ³⁸"]42_ "

Gp'wpl'cf gu'UK< m³"?" "20639"]43_ "

eqp'f₇₂ gp'o gvtqu0 Gp'wpl'cf gu'co gtlecpuc<

m³"?" "20564"]44_ "

eqp'f₇₂ gp' r kgu0

CuÀo cug's wg'f _u ? f ₇₂ ¿	
p ⁴ ? 'm ₃ 'f _u ^{3B} '''	145_
p ⁴ ? 'm ₃ 'f _u ^{3B} '''	146_
Eqo dlkpcpf q'rcu'gewckep'p'39'f'46¿	
h ⁴ ? 'm ₃ 'f _u ^{3B} '''	147_

La Concentración de Sedimentos"

Uwdunkw' gpf q'rc'gewckep'47'gp'rc'gewckep'36¿	
E _u ? " 'm ₃ 'U _q]m ₃ ⁴ 'f _u Π ^{3B} '''	148_
Rqt'rq'cpvq.'rc'eqpegp'ckep'f'g'ugf ko gpqu'gu¿	
E _u ? ']' 'm ₃ 'f _u Π ^{3B} '''	149_
Nvgi q¿	
S _u 'S _y ? ']' 'm ₃ 'f _u Π ^{3B} '''	14: _
{ <	
S _u 'f _u Π ^{3B} ''' ']' 'm ₃ 'f _u Π ^{3B} ''' 'S _y 'U _q '''	14: _

La Relación de Lane Modificada"

F g' cewgtf q' c' rc' gewckep' 4; . ' rc' tgrckep' f g' Ncpg' o qf hkecf c'gu¿	
S _u 'f _u Π ^{3B} ''' 'S _y 'U _q '''	152_
Gp'wplf cf gu'UK'rc'gewckep'4; 'gu¿	
S _u 'f _u Π ^{3B} ''' ']' 'm ₃ 'f _u Π ^{3B} ''' '20693 ⁴ +' 'S _y 'U _q '''	153_
S _u 'f _u Π ^{3B} ''' ']' '67Q 7'm ₃ ' 'S _y 'U _q '''	154_
S _u '? '67Q 7'm ₃ ' 'S _y 'U _q 'f _u Π ^{3B} '''	155_
Rctc' " ? '3'vqp lo ⁵ ¿	
S _u '? '67Q 7'm ₃ ' 'S _y 'U _q 'f _u Π ^{3B} '''	156_
gp'rc'ewcnS _u 'gp'vqpu'f' 'S _y 'gp'o ⁵ h0''	
[<	
S _u '? '5.; 92.2: 2'm ₃ ' 'S _y 'U _q 'f _u Π ^{3B} '''	157_
gp'rc'ewcnS _u 'gp'vqpu'f' 'S _y 'gp'o ⁵ h0''	
Gp'wplf cf gu'co gtecpu¿	
S _u 'f _u Π ^{3B} ''' ']' 'm ₃ 'f _u Π ^{3B} ''' '20564 ⁴ +' 'S _y 'U _q '''	158_
S _u 'f _u Π ^{3B} ''' ']' '7: 8: 'm ₃ ' 'S _y 'U _q '''	159_
S _u '? '7: 8: 'm ₃ ' 'S _y 'U _q 'f _u Π ^{3B} '''	15: _
Rctc' " ? '840'rdulr kg ⁵ ¿	
S _u '? '5.884'm ₃ ' 'S _y 'U _q 'f _u Π ^{3B} '''	15: _
gp'rc'ewcnS _u 'gp'rdulu'f' 'S _y 'gp'r kgu ⁵ h0''	"
[<	
S _u '? '37: .3: 4'm ₃ ' 'S _y 'U _q 'f _u Π ^{3B} '''	162_
gp'rc'ewcnS _u 'gp'WU'vqpu'f' 'S _y 'gp'r kgu ⁵ h0''	

Gn'r ct^a o gxtq'm₃'xct'p'v'f'leco gpvg'gp'gn'tcpi q'2027'Ö'm₃'Ö' 20240''

Aplicaciones"

CuÀo cpug' f qu' ecuqu. ' wq' cpvqu' { ' q'q' f gur w' u' f gni' f gucttqmq. ' eqp' uwd'p'f'kgu' 3' c'p'f' 4. ' tgr' gexcco gpv0' Cf go ^a u'ug'f'ghkpgp¿	
c ² ? 'S _u 'S _y '''	163_
d ² ? 'f _u 'f _u '''	164_
e ² ? 'T ₄ Π ₃ '''	165_
f ² ? 'S _y 'S _y '''	166_

g ² ? 'U ₄ U _q '''	167_
Wucpf q'rc'tgrckep'f'g'Ncpg'o qf hkecf c'Gewckep'52+¿	
c ² 'd'le ^{3B} '? 'f'g'''	168_
Rqt'rq'cpvq.'rc'tgrckep'f'g'r gpf kpgvu'gu¿	
g ² ? 'c'f + 'd'le ^{3B} '''	169_

Glgo r nq'P q03''

Wp' tco q' f g' t'f' ci wcu' cdclq' f g' wpc' dqecvqo c' eqp' f guctgpcf qt'ghgexq.'eqp'c''? '2Q ; . 'd''? '3.'e''? '2Q 7. '{ 'f''? '2Q . 't'gwuct^a 'gp'g'? '3084'ci tcf cekp-0''

Glgo r nq'P q04''

Wp' tco q' f g' t'f' ci wcu' cdclq' f g' wpc' tgr t'guc' f g' t'gvpkcp' f g' ugf ko gpvqu.'eqp'c''? '206.'d''? '3.'e''? '2Q 7. '{ 'f''? '2Q . 't'gwuct^a 'gp'g'? '206'f' gi tcf cekp-0Gp'rc' r t' evlec.'guc'Anko c'r wgf g' ugt' n'ko kcf c' r qt' eqpvtqru' i ggn'i lequ' *ceqtcl co kpvq. ' q' f gi tcf cekp' j' c'uc' gpeqptct' gn'dcuco gpvq' t'qeqqu' # 'Hki wtc' 3-0''

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Figura 1.-F gi tcf cekp'j' c'uc'c'ncp| ct'gn'dcuco gpvq' t'qeqqu.'ci wcu'cdclq'f'g'wpc'tgr t'guc'f'g't'gvpkcp'f'g' ugf ko gpvqu.'Ci w'lg'f'g're'Vwpc.'Vl'wpc.'D'clc' E'c'rh'q'p'k.'O²z'leq.'gp'gt'q'f'g'3; ; 50''